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Air quality impact evaluation of a hypothetical fire-fighter training facility

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AIR QUALITY IMPACT EVALUATION OF A HYPOTHETICAL FIRE-FIGHTER TRAINING FACILITY

by

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A Dissertation Presented in Partial Fulfillment
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ABSTRACT

Human Health Risk Assessments (HHRAs) have become a required component in the permitting process for hazardous waste incinerators and boilers and for closure or evaluation of chemical and petroleum facilities. However, although not currently required, these evaluations are also essential for additional daily processes having the potential to adversely impact the environment. One such process includes emissions produced from a firefighter training facility. Firefighter training facilities perform scenarios to enhance the firefighting ability of the trainees. Three typical scenarios conducted at such a facility include air rescue and firefighting, building fire simulation, and propane system fires. During the course of these scenarios, various fuels (e.g., gas, diesel, wood, hay, and propane) are burned, resulting in the release of both uncombusted fuel constituents and other constituents formed during the combustion process (e.g., carbon monoxide and volatile organics). These constituents are potentially transported by air to the surrounding communities where people may come in contact with the constituents.

To evaluate the potential health effects of these releases, a multimedia, multipathway HHRA was conducted using the USEPA guidance document, *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities* (USEPA 1998). This assessment included both direct (inhalation) and indirect pathways of exposure to constituents potentially emitted during the training scenarios. Priority pollutants (i.e.,

particulate matter, sulfur oxides, nitrogen oxides, and carbon monoxide) were evaluated in this assessment. Estimated emission rates for the priority pollutants were used to estimate air concentrations that were then compared with their respective National Ambient Air Quality Standard.

The results of the HHRA indicated a low potential of increased risk to the surrounding population from the combustion of materials used in the firefighter training scenarios. The highest estimated total excess lifetime cancer risks were 2 in 100 million and 4 in 10 million for the direct and indirect pathways, respectively. These values were substantially less than the USEPA's (USEPA 1998) benchmark of 1 in 100,000 for cancer risks and 0.25 for noncarcinogenic hazards, even when summed over all constituents and scenarios.

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LIST OF ACRONYMS

µg	micro-gram
ADI	Average Daily Intake
AEGL	Acute Inhalation Exposure Guideline
AIEC	Acute Inhalation Exposure Criteria
AQIA	Air Quality Impact Assessment
ARFF	Airport Rescue and Firefighting
ASCII	American Standard Code for Information Exchange
ATEL	Acute Toxicity Exposure Levels
BAF	Bioaccumulation Factor
BCF	Bioconcentration Factor
BSAF	Biota-to-sediment Accumulation Factors
BTU	British Thermal Unit
cm	centimeter
CO	carbon monoxide
COC	Chemical of Concern
CSF	Cancer Slope Factor
CST	Central Standard Time
ELCR	Excess Lifetime Cancer Risk
EMF	Emission Factor
ERPG	Emergency Response Planning Guidelines
ft	foot
g/s	gram/second
gal	gallons
HEAST	Health Effects Assessment Summary Tables
HHRA	human health risk assessment
HI	Hazard Index
HQ	Hazard Quotient
hr	hour
in	inch
IRIS	Integrated Risk Information System
ISCST3	Industrial Source Complex Short Term Version 3
K	Kelvin
kg	kilogram
km	kilometers
lb	pound
LDEQ	Louisiana Department of Environmental Quality
LOAEL	Lowest Observed Adverse Effect Level

LPG	Liquid Petroleum Gas
m	meter
MEF	Median Emission Factor
mg	milligram
mm	millimeter
NAAQS	Nation Ambient Air Quality Standards
NCDC	National Climatic Data Center
NOAEL	No Observed Adverse Effect Level
NO_x	nitrogen oxides
NWS	National Weather Service
PAH	Polycyclic Aromatic Hydrocarbons
PIC	Products of Incomplete Combustion
PM	Particulate Matter
ppm	parts per million
RfC	Reference Concentration
RfD	Reference Dose
SCAPA	Subcommittee on Consequence Assessment and Protective Actions
SCRAM	Support Center for Regulatory Air Models
SI	International System of Units
SO_x	sulfur oxides
SVOC	Semi-volatile Organic Compounds
TEEL	Temporary Emergency Exposure Limits
TEF	Toxicity Equivalency Factor
TEQ	Toxicity Equivalent
UCF	Uncertainty Factor
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UTM	Universal Transverse Mercator
VOC	Volatile Organic Compounds
yr	year

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1.0 INTRODUCTION

Throughout the United States, firefighters are being trained at firefighter training facilities. Each day these facilities conduct training exercises to simulate real-life fire situations. During these simulations, wood products, hay products, and petroleum products are combusted forming products of incomplete combustion (PICs). While some attention has been given to the potential human health effects of burning petroleum products in utility boilers for the generation of electricity, no evaluation has been performed to assess the potential impact that a firefighter training facility may have on the surrounding area.

This report provides some input into the potential human health impacts from the combustion of materials at a hypothetical firefighter training facility. Information used to assess these impacts was selected in a manner that would provide a conservative estimate of the impact. As such, the facility selected was assumed to provide firefighter training on a continuous basis and therefore would be most applicable to a training center providing services to a regional base as opposed to a local base. However, these results can serve as an upper bound on the impact expected from a less frequently used facility.

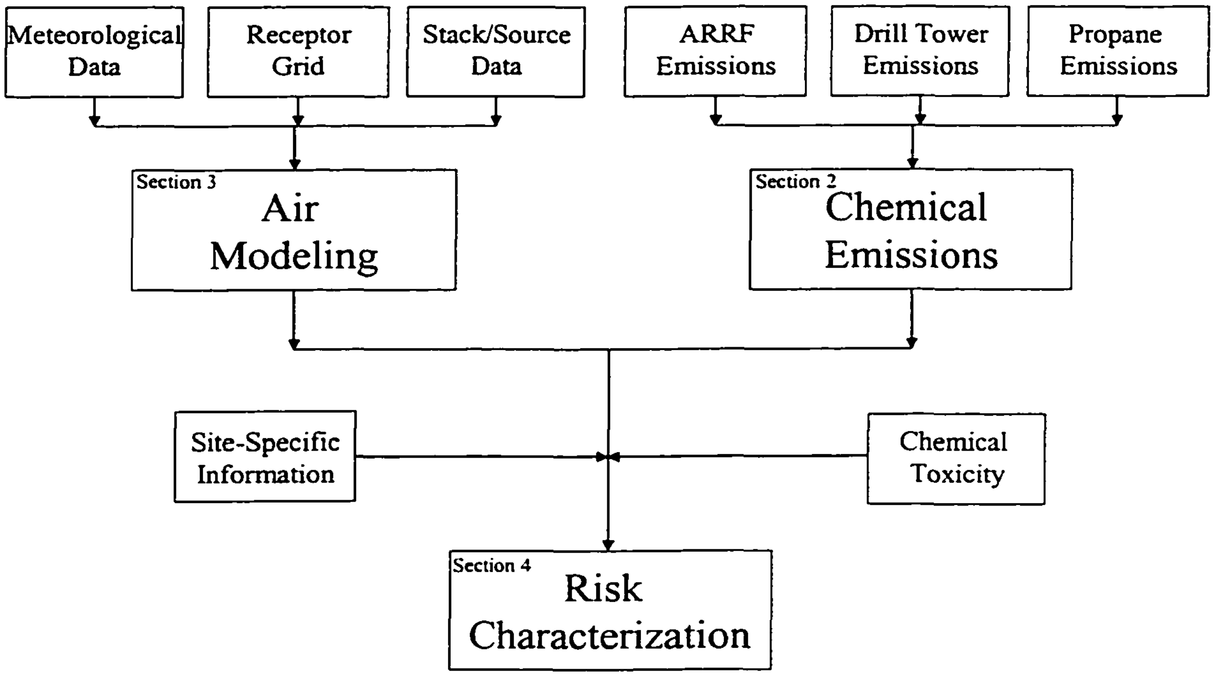
Numerous steps were required to determine the human health impact resulting from the combustion of material during the firefighter training scenarios. These steps are displayed in Figure 1 and include

- the determination of the chemicals being emitted and their estimated rate of emission,

- the performance of air modeling for each specific combustion source at the facility to determine the estimated air concentrations and deposition rates, and
- the characterization of risk associated with the emitted compounds at their estimated concentrations and deposition rates.

Figure 1. Air Quality Impact Evaluation Steps

For the purposes of this research, the hypothetical facility (Facility) was assumed to be north of the city limits of Ruston, Louisiana, in Lincoln Parish. The location selected



is near the junction of Louisiana Highway 33 and Arkansas Plant Road (Figure 2). It was assumed that within the Facility, three areas -- the airport rescue and firefighting (ARFF) area, the propane system area, and the drill tower area-- are used to conduct "training" scenarios (Figure 3). During the training scenarios, wood products, hay products, and/or petroleum products are combusted to simulate real-life fire situations. The

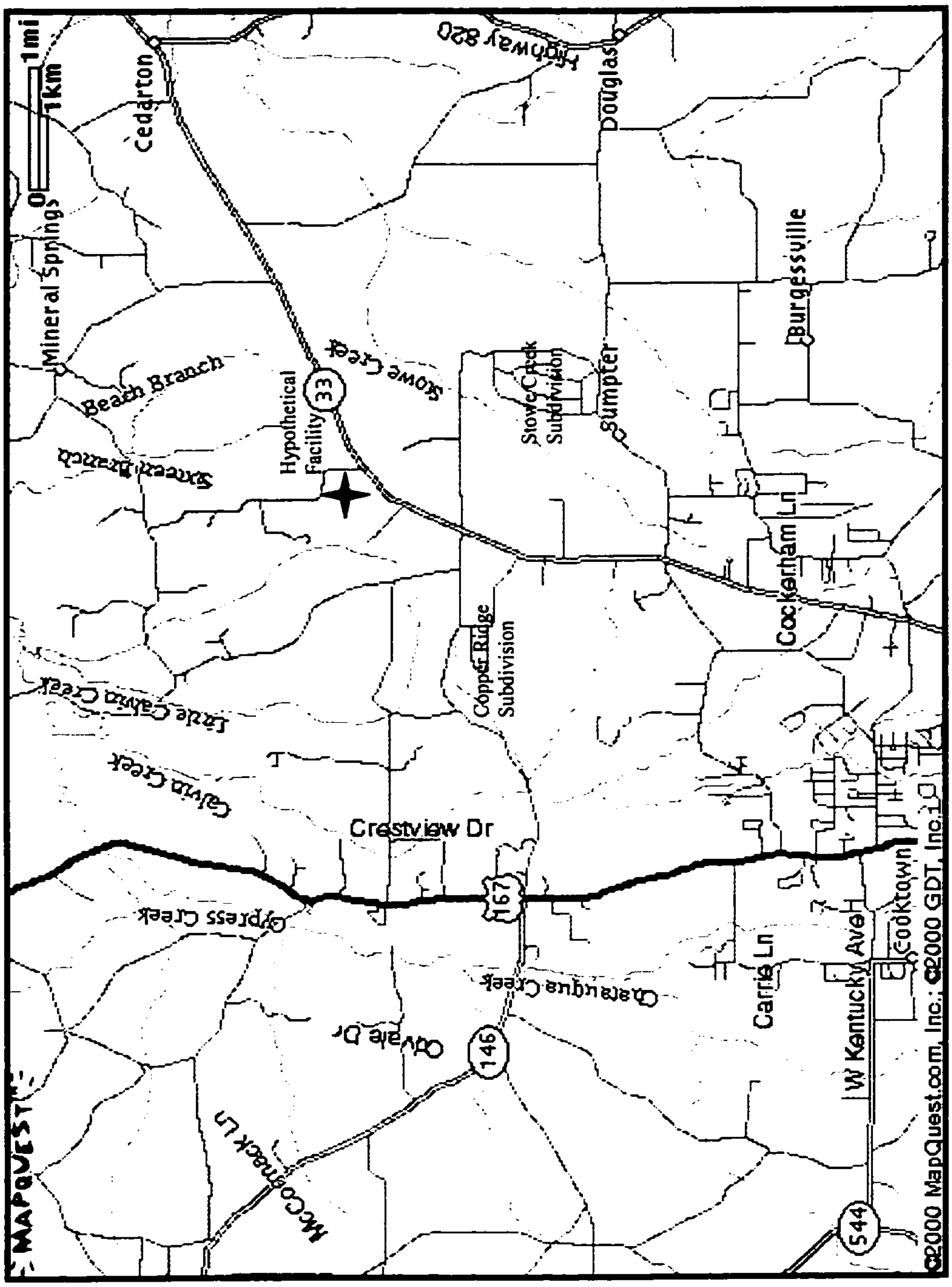


Figure 2. Lincoln Parish Road Map

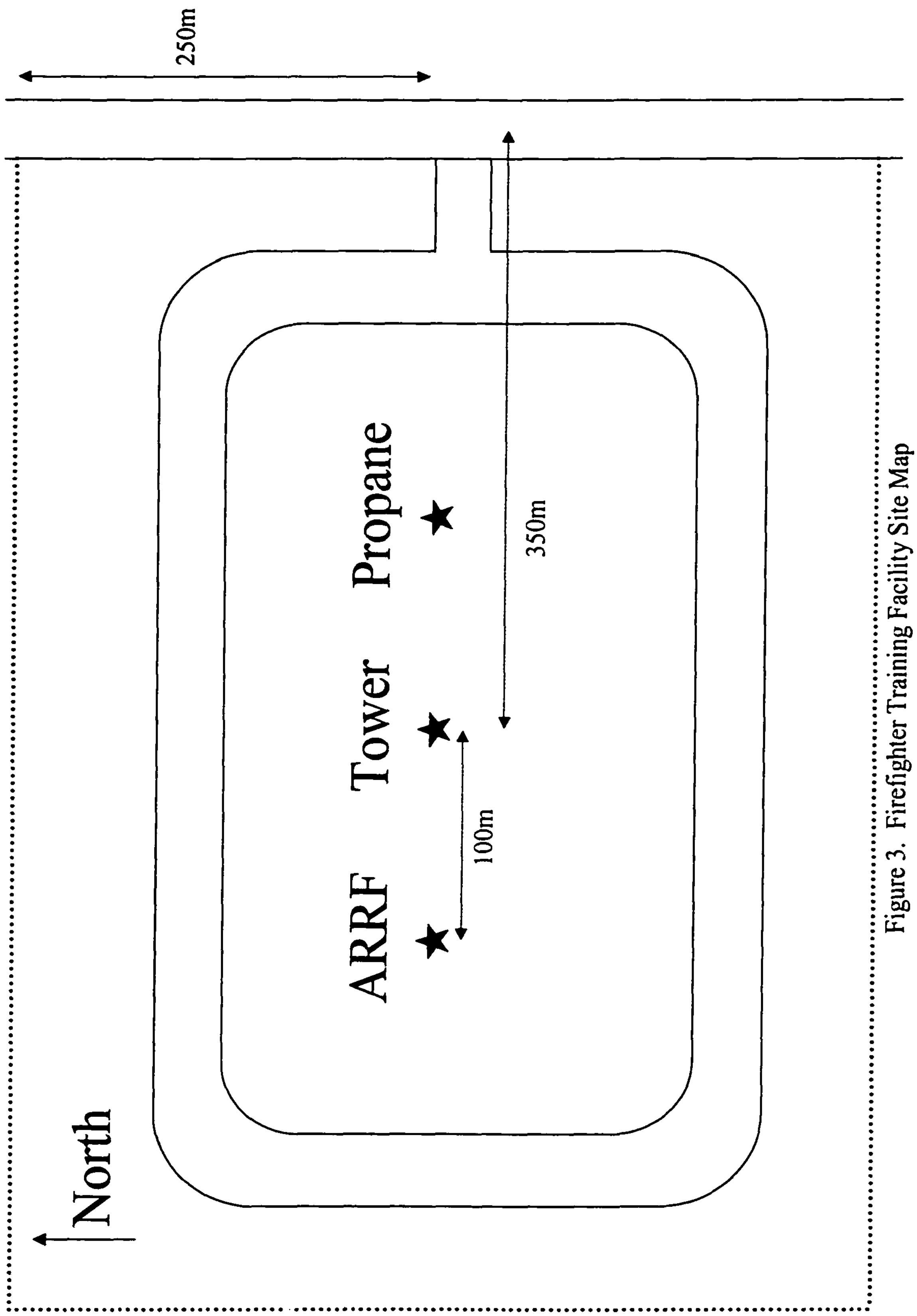


Figure 3. Firefighter Training Facility Site Map

products, and the amounts used in each area, are provided in Table 1 (Potucek 1999). Each area is briefly discussed below with a more complete discussion provided in Section 3:

- ARFF - This training scenario, used to simulate an airplane crash, is conducted in the ARFF area once per day, and, as indicated in Table 1, uses 50 gallons (gal) each of gasoline, diesel, kerosene, and aviation fuel.

- Propane Systems - The propane system simulates actual fire conditions that allow the trainee to build a sense of confidence in extinguishing fires. As indicated in Table 1, 25 training scenarios are performed per day in the propane systems area. During each training scenario, 15 pounds (lb) of propane is used.

- Drill Tower - While the drill tower is used for laddering and testing physical ability, it is also used to simulate fires in a building. As indicated in Table 1, three training scenarios are performed each day in which 500 lb of hay and 100 lb of wood are burned to simulate real fire conditions. In addition to the hay and wood, 15 lb of propane are used to initiate the fires.

Table 1. Potential Fuel Use at the Firefighter Training Facility

Area	**Type of Fuel**	**# of Classes per Day**	**Fuel Used Per**			
			Class	**Day**	**Month**	**Year**
Drill Tower	Hay (lb)	3	500	1500	30000	360000
	Lumber (lb)	3	100	300	6000	72000
	Propane (lb)	3	15	45	900	10800
Propane Systems	Propane (lb)	25	15	375	7500	90000
Air Rescue and Firefighting	Gasoline (gal)	1	50	50	1000	12000
	Aviation Fuel (gal)	1	50	50	1000	12000
	Diesel (gal)	1	50	50	1000	12000
	Kerosene (gal)	1	50	50	1000	12000

During the course of these training exercises, various fuels (e.g., gasoline and wood) are burned resulting in the release of both uncombusted fuel constitutes and other constituents formed during the combustion process (e.g., carbon monoxide). These materials may be transported in the air to the surrounding areas where people living or working, or ecological receptors, may come in contact with these chemicals. To assess the effect on human health, an Air Quality Impact Assessment (AQIA) was conducted for the hypothetical site. Assessment of the air quality impact associated with the burning of materials used during training scenarios at the facility included an evaluation of the potential human health risks assessed using multimedia, multipathway analyses and a comparison of the potential amount of the priority pollutants, carbon monoxide (CO), nitrogen oxides (NO_x), sulfur oxides (SO_x), and particulate matter (PM), released during training exercises with their corresponding National Ambient Air Quality Standards (NAAQS) (USEPA 1990a).

An estimate of the chemical emissions to the atmosphere from each of the scenarios discussed above, -- ARFF, propane system, and drill tower -- is required to assess the potential impact on the air quality. Since no actual emission data specific to the training scenarios were available, a review of literature was performed to provide these estimates. This literature review and the procedure used for estimating the emissions is discussed in Section 2. Air modeling to estimate the concentration and deposition of the chemicals being emitted was also performed for each of the scenarios and are discussed in Section 3. The estimated emissions and air modeling values were then used to conduct the human health risk assessment (HHRA). The methodology and results of the HHRA, along with uncertainties related to the selection of chemicals, air modeling, fate and transport, and other aspects of the risk assessment, are presented in Section 4. Comparisons of the concentrations of priority pollutants with the NAAQS are presented in Section 5. A summary of the results of the AQIA is presented in Section 6.

1.1 Demographics

The hypothetical facility is assumed to be in Lincoln Parish just north of the city limits of Ruston, Louisiana, and just east of the intersection of Louisiana Highway 33 and Arkansas Plant Road. The facility is just south of the Lincoln Parish Landfill. Residential dwellings are sparsely located on Arkansas Plant Road north of the facility and along the other roads in the area. The nearest residence was identified to be approximately 0.8 kilometers (km) (0.5 mile) north of the facility just off Arkansas Plant Road. No schools, day care facilities, retirement homes, or other establishment which would contain sensitive receptors were noted in the area. Most of the people living within a 3 km radius of the facility reside within the subdivisions of Copper Ridge and Stow Creek, located to the southwest and southeast of the facility, respectively. Figure 4 is a composite topographic representation of the area with the facility clearly identified.

Two cattle ranches, Max-JoAnn King Farms and T.D. Cattle Farm are within 3 km of the facility. Max-JoAnn King Farms lies approximately 2.1 km to the east and T.D. Cattle Farm approximately 2.7 km to the southeast. No dairy farms, chicken houses, or swine production were noted within a 3 km radius of the facility during a site visit. The nearest surface waterbody is a small creek, approximately 1.5 km west of the facility. The creek runs in a south-to-north direction. No name for the creek was found but it eventually

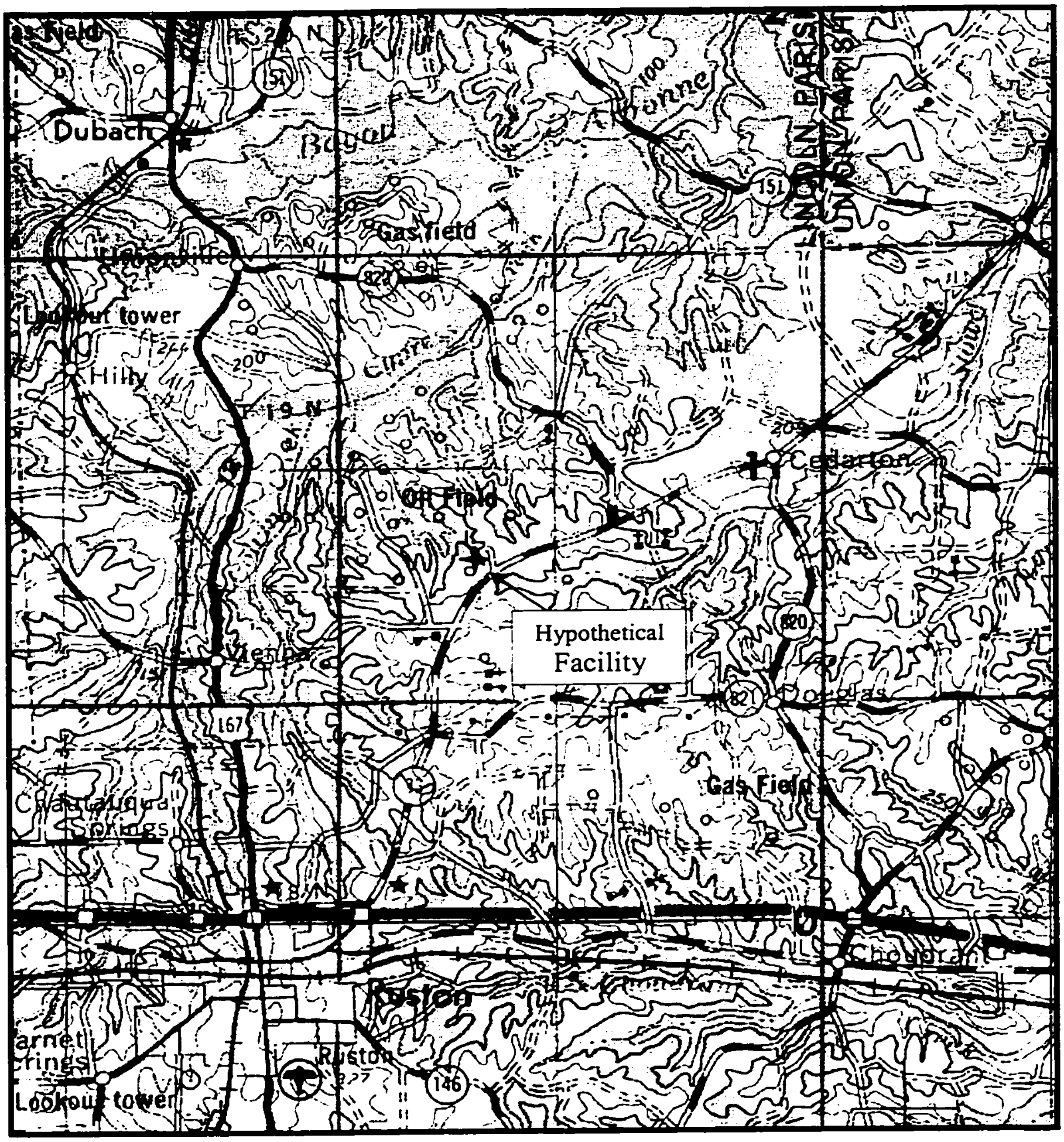


Figure 4. Topographic Map of the Area
Surrounding the Firefighter Training Facility

feeds into Cypress Creek. For the purposes of this report, the creek will be referred to as "Selected" creek.

1.2 Overview of the Human Health Risk Assessment

A multipathway HHRA was conducted for the three training scenarios (ARRF, propane system, and drill tower) expected to be performed at the hypothetical facility. This multipathway risk assessment included both direct and indirect pathways of exposure to chemicals potentially emitted during the training scenarios conducted at the facility. Inhalation of any residual chemical released to the air is a direct exposure pathway. The underlying assumption in an indirect risk assessment is that chemicals released to the air can be transported off-site and deposited onto soil, water, or vegetation. Indirect pathways are those resulting from contact of human receptors with soil, plants, or waterbodies on which the emitted chemical has been deposited. Indirect pathways include, for example, ingestion of vegetables, beef, milk, fish, pork, poultry, eggs, or surface water in which trace amounts of chemicals may have been incorporated into the food chain from soil, plants, or water containing the emitted chemical. The degree to which a measurable increase in risk occurs from indirect exposures is not only dependent on the amount of chemical released to the air and the toxicity of that chemical, but also on the chemical's physicochemical properties and the degree to which such properties enhance fate and transport through those indirect pathways.

The basic approach to this multimedia risk assessment involved

- identifying the chemicals that may be emitted during the training scenarios and quantifying the potential emission rate for each selected chemical;

- estimating the amount of chemical in these emissions that may be transported from the source, the predominant direction of that transport, and the points of maximum deposition based on site-specific meteorological data;

- identifying the current actual and reasonable future receptors and the pathways (e.g., ingestion of soil, water, vegetables, beef, milk, pork, poultry, or eggs) by which these receptors may be exposed to released chemicals by way of one or more of the identified pathways;

- quantifying concentrations of the emitted chemicals in the relevant media (air, soil, surface water, vegetation, beef, milk, pork, poultry, or eggs);

- estimating the amount of chemical exposure (intake); and,

- estimating the excess lifetime cancer risk (ELCR) and noncancer hazard risk associated with that level of intake for each of the receptors for each of the pathways, evaluating the uncertainties in the assessment, and interpreting the estimated risks.

The HHRA was conducted using a receptor location corresponding to the maximum off-site concentration and deposition location in order to provide a conservative estimate as to the risk to an individual who might live near the facility in the future. Although, as indicated in Section 1.2, no dairy farms, chicken houses, or swine production facilities were identified in the immediate area, for this conservative assessment it was assumed that a subsistence farmer could raise these products in the future. There are no waterbodies in the area capable of supporting a subsistence fisher. However, to provide a conservative estimate on any potentially risk associated with the consumption of fish in the area, the assumption was made that "Selected" Creek could support a subsistence fisher.

Given the multitude of indirect pathways and receptors that could be envisioned, this assessment was conducted using United States Environmental Protection Agency (USEPA) guidelines for multimedia risk assessments (USEPA 1998a). The methods and approaches used within this assessment are also consistent with other risk assessment guidelines (USEPA 1989, 1992a, 1992b). The approach used within this assessment was based on health protective assumptions; therefore, according to the USEPA Guidance (USEPA 1998a), if the final estimated ELCR is below one in 100,000 (1×10^{-5}) for each receptor for all chemicals and all pathways evaluated for that receptor, then no significant off-site impacts due to potential emission from the training scenarios are expected. Estimates of risk are probability statements, and as with all probability statements, range from 0 (never will happen) to 1 (always will happen). An estimated ELCR of 1×10^{-5} is a one in 100,000 chance (probability) that an individual exposed at the level described would develop cancer.

The typical screening standard used in noncarcinogenic evaluation is referred to as the hazard quotient (HQ). The HQ is defined as the ratio of the intake concentration of the chemical by the receptor to the smallest concentration that would produce the noncarcinogenic affect. If the final HQs are below 0.25 for each chemical or 1.0 for the sum of HQs for chemicals with a similar toxicity endpoint, again across receptors and pathways, then no significant off-site impacts due to potential emissions from the training scenarios would be expected.

1.3 Overview of Priority Pollutants Analysis

Priority pollutants – PM, SO_x, NO_x, and CO – do not have standard toxicity values. Rather, these chemicals have promulgated NAAQS that cannot be exceeded. For a permitted facility (e.g., a chemical manufacturing facility, petroleum facility, etc.), an exceedance of the NAAQS would require an exceedance notification be sent to the appropriate regulatory agency, such as the USEPA or the Louisiana Department of

Environmental Quality (LDEQ). While firefighter training facilities are currently not required to be permitted nor monitor their emissions, the comparison of their expected emission rates of priority pollutant with the appropriate NAAQS provides information on any expected exceedances. Therefore, estimated emission rates for the priority pollutants were used to estimate the air concentrations of each priority pollutant, and this concentration was compared with the respective NAAQS.

1.4 Units

This report uses a mixture of English and International System of Units (SI). In general, English units are used when discussing inputs (fuel used during the training scenarios) and SI units are used when discussing outputs (e.g., emission estimates, concentrations, etc.).

2.0 EMISSION ESTIMATES

This step in the AQIA process included the identification of the chemicals that may be released to the air during the various training scenarios. Typically, risk assessments use actual emissions data determined using representative fuels and representative burning conditions. However, because this is a hypothetical firefighter training facility, actual emissions data were not available. Therefore, identification of the chemicals that could be released during the training scenarios for each of the fuels to be used were obtained from published literature. Emission estimates for these chemicals were then based on the planned fuel usage for the facility as indicated in Table 1. An initial literature search was conducted to determine if any representative data were available from other firefighter training facilities. Since no data were located, the literature search was then focused to obtain representative data from similar combustion processes.

The facility will generate emissions from several fuels, including diesel, gasoline, aviation fuel (assumed to be jet fuel), kerosene, propane, wood, and hay. As presented in Table 1, it is estimated that the facility will burn 12,000 gal each of diesel, kerosene, gasoline, and aviation fuel per year during its ARFF scenarios. It is also anticipated that 90,000 lb of propane will be burned during the year in the propane system scenarios, while 72,000 lb of wood, 360,000 lb of hay, and 10,800 lb of propane will be burned per year in the drill tower scenarios. A description of the anticipated emissions from the ARFF scenario, the propane systems scenario, and the drill tower scenario are presented in Section 2.1, 2.2, and 2.3, respectively. Table 2 provides a quick reference to the source used in this report to estimate the emissions from the various scenarios.

Table 2. Literature Sources Used in Defining a List of Expected Compounds from the Various Firefighter Training Scenarios

Scenario	Fuel	Data Source		
		Organics	Inorganics	Priority Pollutants
ARRF	liquid fuel	USEPA 1998b	USEPA 1998b	USEPA 1995a Section 3
Propane	propane	USEPA 1998b	USEPA 1998b	USEPA 1995a Section 5
Tower	wood	USEPA 1990b	USEPA 1990b	USEPA 1995a Section 9
	hay	Jenkins, *et al.* 1996	Jenkins, *et al.* 1996	Jenkins, *et al.* 1996

2.1 Emission Estimates for the ARFF Scenario

During the ARFF scenario the fuel (e.g., diesel, gasoline, aviation fuel, and kerosene) is expected to be burned in an open pit or on the ground. A literature search was conducted for each fuel for potential emissions formed from the burning of these fuels during an open burn; however, no data were found for any of the fuels related to open burning. Extensive data were found for car exhaust emissions from the use of diesel and gasoline fuel, but these were not expected to accurately represent the emissions from an open burn. No emission data could be located for aviation fuel or kerosene. Data located that most accurately represented the conditions of the ARFF scenario were reported in the USEPA Utilities Report (USEPA 1998b), which defined expected emissions from the burning of No. 6 fuel oil (diesel) in oil-fired boilers. These data were considered preferably over diesel exhaust data for the following reasons:

- more control is exhibited over the air-fuel mixture in the internal combustion engine than in the oil-fired boiler;
- the temperature in the combustion zone is higher in the internal combustion engine (approximately 820° F) than in the oil-fired boiler (300° to 600° F);
- the combustion area within the internal combustion engine is significantly smaller than that within the oil-fired boiler with the wall area impacting the combustion process; and
- in an internal combustion engine, the combustion process involves first heating the air (by compression) and then injecting vaporized fuel which is immediately combusted, whereas in an oil-fired boiler, the fuel and air are supplied at a constant rate, and therefore results in a continuous combustion process more representative of an open burn.

Because aviation fuel and kerosene are removed from the same fraction as diesel, it is expected that their constituents would be similar to diesel (Jones 2000). Therefore, the emission factors for diesel (USEPA, 1998b) were used as surrogates for kerosene and aviation fuel. As discussed above, the only emission factors that could be located for gasoline were from car exhaust with no data available for open burning of gasoline or using gasoline as fuel in a boiler. Since gasoline is a more refined petroleum product than diesel, it is expected to contain fewer impurities. Therefore, it is anticipated that the emissions from gasoline would contain smaller amounts of metals and semi-volatile organic compounds (SVOCs) than diesel but contain higher concentrations of certain volatile organic compounds (VOCs). Therefore, the diesel emission factors from USEPA (1998b) were used as surrogates for gasoline. Uncertainties associated with the use of the emission data from the USEPA Utilities Report (USEPA 1998b) are discussed in Section 4.4.1.1.

As reported in the USEPA Utilities Report, the USEPA conducted a survey of the emissions from coal-fired, oil-fired, and natural gas-burning power plants. Actual data for selected facilities, expressed as either parts per million (ppm) in the fuel for inorganic chemicals or as lb per trillion British thermal units (BTUs) generated for organic chemicals detected in stack emissions, were calculated for individual facilities. For organic chemicals, the data from a number of facilities were combined to provide median emission factors (MEFs). Because the same emission factors are used for diesel, kerosene, gasoline and aviation fuel, the amounts of these fuels, defined as liquid fuels, used at the facility were summed; and thus, one combined emission rate is reported for these fuels.

2.1.1 Estimates of Emissions for Organic Compounds for the ARFF Scenario

The USEPA Utilities Report provided estimated emissions of VOCs and SVOCs, as well as potential emissions for the 2,3,7,8-dioxin and furan congeners, expressed as an MEF in units of lb/trillion BTU for fuel oil. While dioxins and furans are contaminants in air emissions of most combustion sources, including forest fires, their concentration in these emissions is typically minuscule. While the existence of dioxin/furan congeners has not been confirmed through any emission analysis on any training scenario conducted at any facility, the USEPA Utilities Report (USEPA 1998b) provides MEFs for many of the dioxin/furan congeners. Therefore, as a health protective assumption, the dioxin/furan congeners were included in the risk analysis. The MEF for each organic chemical was determined using stack emissions data from multiple fuel oil-fired boilers. According to the USEPA (1998b), not all of these chemicals, in particular not all of the dioxins and furans or polycyclic aromatic hydrocarbons (PAH), were detected in stack emissions from every utility facility surveyed. However, a composite list of chemicals was constructed from the emissions at each of the individual plants surveyed to develop a list of chemicals that could be released at any facility that used fuel oil. Because no formal emissions test has been performed to date to simulate firefighting training scenarios, the MEFs provided in the USEPA Utilities Report were used to determine an estimated emission rate for organic chemicals resulting from combustion of liquid fuels. Table 3 lists the MEFs, as reported in the USEPA (1998b), for potentially emitted VOCs and SVOCs and for 2,3,7,8-dioxin/furan congeners. The 2,3,7,8-TCDD congener, considered the most toxic dioxin/furan congener, was not detected in any emissions sample evaluated by the USEPA, as reported in USEPA (1998b) and therefore is not included in this assessment.

Equation 1 was used to estimate an emission value for each organic chemical of concern (COC).

$$\text{COC}\ \frac{\text{lb}}{\text{yr}} = \text{Liquid Fuel}\ \frac{\text{gal}}{\text{yr}} \times \frac{150{,}000\ \text{BTU}}{\text{gal}} \times \frac{\text{trillion BTU}}{10^{12}\ \text{BTU}} \times \frac{\text{MEF lb}}{\text{trillion BTU}} \qquad (1)$$

As an example, using Equation 1, the consumption rate of liquid fuels for the facility of 48,000 gal/yr, and a MEF of 8.2 lb/trillion BTU for acetaldehyde, an estimated emission rate of 0.059 lb/yr (8.5×10^{-7} gram/second [g/s]) was calculated. The estimated emission rates (g/s) for all VOCs, SVOCs, and 2,3,7,8-dioxin/furan congeners are listed in Table 3. These emission estimates were not measured during any formal emission test, but rather are intended to describe potential emissions resulting from combustion of liquid fuels at the facility during training scenarios.

Table 3 Emission Factors and Emission Estimates for Liquid Fuel and Propane for Organic Compounds

Chemical Name	Air Rescue & Firefighting		Propane System	
	MEF (oil)	Emission from Liquid Fuel (g/s)	MEF (gas)	Emission from Propane (g/s)
Acetaldehyde	8.2	8.49E-07		
Benzene	1.4	1.45E-07	1.4	1.54E-08
Ethylbenzene	0.49	5.08E-08		
Formaldehyde	30	3.11E-06	29	3.19E-07
Methyl Chloroform	7.6	7.87E-07		
Methylene Chloride	32.25	3.34E-06		
Naphthalene	0.34	3.52E-08	0.67	7.37E-09
Phenol	24.3	2.52E-06		
Tetrachloraethylene	0.55	5.70E-08		
Toluene	8	8.29E-07	10.2	1.12E-07
Vinyl acetate	5.15	5.33E-07		
o-Xylenes	0.84	8.70E-08		
m,p-Xylenes	1.35	1.40E-07		
2-methlynaphthalene	0.017	1.76E-09	0.026	2.86E-10
Acenaphthene	0.358	3.71E-08		
Acenaphthylene	0.017	1.76E-09		
Anthracene	0.015	1.55E-09		
Benz[a]anthracene	0.03	3.11E-09		
Benzo[]fluoranthene	0.033	3.42E-09		
Benzo[]perylene	0.021	2.18E-09		
Chrysene	0.021	2.18E-09		
Dibenzo[]anthracene	0.008	8.29E-10		
Fluoranthene	0.016	1.66E-09	0.003	3.30E-11
Fluorene	0.021	2.18E-09	0.003	3.30E-11
Indeno[123c,d]pyrene	0.024	2.49E-09		
Nitrobenzofluoranthene	0.015	1.55E-09		
Nitrochrysene/benzanthracene	0.016	1.66E-09		
Phenanthrene	0.025	2.59E-09	0.013	1.43E-10
Pyrene	0.037	3.83E-09	0.005	5.50E-11
1,2,3,7,8-Pentachlorodibenzo(p)dioxin	4.00E-06	4.14E-13		

Table 3 (continued)

Chemical Name	Air Rescue & Firefighting		Propane System	
	MEF (oil)	Emission from Liquid Fuel (g/s)	MEF (gas)	Emission from Propane (g/s)
1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin	9.90E-06	1.03E-12		
1,2,3,6,7,8-Hexachlorodibenzo(p)dioxin	8.20E-06	8.49E-13		
1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	9.60E-06	9.94E-13		
1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	5.90E-05	6.11E-12		
Heptachlorodibenzo dioxin	1.20E-04	1.24E-11		
Hexachlorodibenzo dioxin	8.20E-05	8.49E-12		
1,2,3,4,6,7,8,9-Octachlorodibenzo(p)dioxin	1.40E-04	1.45E-11		
Pentachlorodibenzo dioxin	8.00E-05	8.29E-12		
Tetrachlorodibenzo dioxin	1.00E-04	1.04E-11		
2,3,7,8-Tetrachlorodibenzo(p)furan	6.70E-06	6.94E-13		
1,2,3,7,8-Pentachlorodibenzo(p)furan	8.20E-06	8.49E-13		
2,3,4,7,8-Pentachlorodibenzo(p)furan	5.90E-06	6.11E-13		
1,2,3,4,7,8-Hexachlorodibenzo(p)furan	9.60E-06	9.94E-13		
1,2,3,6,7,8-Hexachlorodibenzo(p)furan	4.40E-06	4.56E-13		
2,3,4,6,7,8-Hexachlorodibenzo(p)furan	2.80E-06	2.90E-13		
1,2,3,4,6,7,8-Heptachlorodibenzo(p)furan	2.00E-05	2.07E-12		
Heptachlorodibenzo furan	2.40E-05	2.49E-12		
Hexachlorodibenzo furan	2.30E-05	2.38E-12		
1,2,3,4,6,7,8,9-Octachlorodibenzo(p)furan	2.10E-05	2.18E-12		
Pentachlorodibenzo furan	4.00E-05	4.14E-12		
Tetrachlorodibenzo furan	1.00E-04	1.04E-11		

2.1.2 Estimates of Emissions of Inorganic Chemicals for the ARFF Scenario

The results of metal analyses on fuel oil used at utility plants as reported in the USEPA Utilities Report are presented in Table 4. For this risk assessment, it was assumed that these metals could be present in all liquid fuels at the values given in the USEPA Utility Report. It was also conservatively assumed that all of the metals estimated to be contained in the liquid fuel would be released in the emissions resulting from these training scenarios. Concentrations of metals in liquid fuels were converted to estimated emission rates using Equation 2.

$$\text{COC}\ \frac{\text{lb}}{\text{yr}} = \text{Liquid Fuel}\ \frac{\text{gal}}{\text{yr}} \times \frac{8.2\ \text{lb}}{\text{gal}} \times \frac{141.5\ -\ \text{API gravity}}{141.5} \times \text{ppm COC} \qquad (2)$$

As an example, using a typical API Gravity of 13.5, the consumption rate of liquid fuels for the facility of 48,000 gal/yr, and a concentration of 26 ppm nickel, an estimated emission rate for nickel of 9.2 lb/yr (1.3×10^{-4} g/s) was calculated. Estimated emissions in g/s for all metals that could potentially be released are listed in Table 4.

2.1.3 Estimates of Emissions of Priority Pollutants for the ARFF Scenario

No data on priority pollutant production during an open burn were found in the literature; therefore, information regarding the potential for their formation was obtained from Chapter 1, Section 3 of the *Compilation of Air Pollutant Emission Factors, Volume 1, Stationary Point and Area Sources* (USEPA 1995a). The emission factors reported for commercial boilers were used, as opposed to industrial boilers, since they provide a smaller heat input capacity and would be more representative of the conditions of the burn

Table 4 Emission Factors and Emission Estimates For Liquid Fuel and Propane for Inorganic Compounds

Chemical Name	Air Rescue & Firefighting		Propane System	
	ppmw	Emission from All Fuel (g/s)	mg/m^3	Emission from Propane (g/s)
Arsenic	0.306	1.56E-06	0.000963	6.61E-10
Cadmium	0.027	1.38E-07		
Cadmium	0.02	1.02E-07		
Chromium	0.31	1.58E-06		
Cobalt	1.63	8.31E-06	0.1	6.86E-08
Chlorine	131	6.68E-04		
Fluorine	17.5	8.92E-05		
Lead	1.41	7.19E-06	0.1	6.86E-08
Manganese	0.35	1.78E-06		
Mercury	0.0092	4.69E-08	0.0000024	1.65E-12
Nickel	26	1.32E-04	0.05	3.43E-08
Selenium	0.095	4.84E-07		

for the ARFF scenario. The priority pollutant emission factors for liquid fuels are summarized in Table 5.

Table 5 Emission Factors For Priority Pollutants

Priority Pollutant	Emission Factor			
	Wood (lb/ton)	Hay (lb/ton)	Propane (lb/1000 gal)	Liquid Fuel (lb/1000 gal)
PM-10	34.6	9.72	0.4	10
CO	252.6	102.4	1.9	5
SO_x	0.4	1.09	0.1	159
NO_x	2.6	5.08	14	55

2.2 Emission Estimates for the Propane System Scenario

Propane is considered a "clean" fuel because it does not produce visible emissions. However, gaseous pollutants such as NO_x, CO, and organic compounds are produced, as are small amounts of SO_x and PM (USEPA 1995a). No specific data for propane related to the production of VOCs and PAHs from the combustion of propane were found; therefore, natural gas was used as a surrogate for propane. Natural gas consists of a high percentage of methane (generally above 85%) and varying amounts of ethane, propane, butane, and inerts (typically nitrogen, carbon dioxide, and helium) (USEPA 1995a). Liquid petroleum gas (LPG), classified as propane, consists of approximately 95% propane and 5% ethane. Therefore, since natural gas has more impurities, it should provide a conservative surrogate for propane.

The emission factors reported in the USEPA Utilities Report (USEPA 1998b) for gas-fired utility plants were used for propane. As reported in the USEPA Utilities Report, the USEPA conducted a survey of the emissions from coal-fired, oil-fired, and natural gas-burning power plants. Actual data for selected facilities, expressed as either milligram (mg) per cubic meter (m^3) of gas for inorganic chemicals or as lb per trillion BTUs generated for organic chemicals detected in stack emissions, were calculated for individual facilities. For organic chemicals, the data from a number of facilities were combined to provide MEFs.

2.2.1 Estimates of Emissions for Organic Compounds for the Propane System Scenario

The USEPA Utilities Report provided estimated emissions of VOCs and SVOCs, expressed as a MEF in units of lb/trillion BTU for natural gas. The MEF for each organic chemical was determined using stack emissions data from gas-fired boilers. According to the USEPA Utilities Report, not all of these chemicals were detected in stack emissions from every utility facility surveyed. However, a composite list of chemicals was constructed from the emissions at each of the individual plants surveyed to develop a list of chemicals that could be released at any facility that used natural gas. Because no formal emissions test has been performed at the Facility to date for the training scenarios, the MEFs provided in the USEPA Utilities Report were used to determine an estimated emission rate for organic chemicals from the facility resulting from the combustion of propane. Table 3 lists the MEFs, as reported in the USEPA Utilities Report, for potentially emitted VOCs and SVOCs.

Equation 3 was used to estimate an emission value for each organic chemical.

$$\text{COC}\ \frac{\text{lb}}{\text{yr}} = \text{Propane}\ \frac{\text{ft}^3\ \text{gas}}{\text{yr}} \times \frac{1000\ \text{BTU}}{\text{ft}^3} \times \frac{\text{trillion BTU}}{10^{12}\ \text{BTU}} \times \frac{\text{MEF lb}}{\text{trillion BTU}} \qquad (3)$$

As an example, using Equation 3, the consumption rate of propane for the facility of 765,000 cubic feet (ft^3)/yr (90,000 lb/yr) and a MEF of 1.4 lb/trillion BTU for benzene, an estimated emission rate of 0.001 lb/yr (1.5×10^{-8} g/s) was calculated. The estimated emission rates (g/s) for all VOCs and SVOCs are listed in Table 3. These emission estimates were not measured during any formal emission tests performed at the facility, but rather are intended to describe potential emissions resulting from combustion of propane at the facility.

2.2.2 Estimates of Emissions of Inorganic Chemicals for the Propane System Scenario

The results of metal analyses on natural gas used at utility plants as reported in the USEPA Utilities Report are presented in Table 4. It was conservatively assumed that all metals contained in propane were emitted. Concentrations of metals potentially in propane were converted to estimated emission rates using Equation 4.

$$\text{COC}\ \frac{\text{lb}}{\text{yr}} = \text{Propane}\ \frac{\text{ft}^3\ \text{gas}}{\text{yr}} \times \frac{\text{mg COC}}{\text{m}^3\ \text{gas}} \times \frac{0.028\ \text{m}^3}{\text{ft}^3} \times \frac{2.21\times10^{-6}\ \text{lb}}{\text{mg}} \tag{4}$$

As an example, using a consumption rate of propane for the facility of 765,000 ft^3/yr, and a concentration of 0.1 mg/m^3 for cobalt, an estimated emission rate of 4.7×10^{-3} lb/yr (6.9×10^{-8} g/s) was calculated. Table 4 lists the estimated emissions in g/s for metals contained in propane.

2.2.3 Estimates of Emissions of Priority Pollutants for the Propane System Scenario

Since the USEPA Utility Report contains no discussion of priority pollutants produced from the burning of propane, information regarding the potential for their formation was obtained from the Chapter 1, Section 5 (Liquified Petroleum Gas) of the *Compilation of Air Pollutant Emission Factors, Volume 1, Stationary Point and Area Sources* (USEPA 1995a). LPG consists of propane, propylene, butane, and butylenes with separate values reported in USEPA 1995a for butane and propane. The emission factors reported for commercial boilers were used, as opposed to industrial boilers, because they provide a smaller heat input capacity and would be more representative of the conditions of the burn during the propane system scenario. The priority pollutant emission factors for propane are summarized in Table 5.

2.3 Emission Estimates for the Drill Tower Scenario

For the drill tower training scenario, the assumption was made that the burns would take place in structures similar to a fireplace. Therefore, burn conditions in the drill tower are expected to be similar to burning wood or hay in a conventional stove or residential fireplace. In these types of burns, significant quantities of unburnt combustibles are produced because fireplaces and stoves are inefficient combustion devices, with high uncontrolled excess air rates and without any sort of secondary combustion. (While some stoves do provide for secondary combustion, the results from such stoves were excluded from this analysis.) The latter is especially important in wood burning because wood is high in volatile matter content, typically 80 percent by dry weight. Emissions from burning within the drill tower are expected to result from incomplete combustion of the wood or hay and to include PM (mainly PM less than 10 micrometers in diameter), CO, SO_x, NO_x, and VOCs and some PAHs (USEPA 1995a).

2.3.1 Estimates of Emissions of Organic Chemicals for the Drill Tower Scenario

Fireplace emissions are highly variable and a function of many wood characteristics and operating practices. Emission factors used to estimate emissions of VOCs and PAHs due to the burning of wood were obtained from the *Effects of Appliance Type and Operating Variables on Woodstove Emissions* (USEPA 1990b). This study assessed the effects on emissions from the combustion of wood by varying specific parameters, i.e., stove type (conventional or catalytic), wood type, altitude, and burn rate. Results from tests using a conventional stove burning pine wood were believed to best fit the conditions of burning wood during the drill tower scenario. Since a catalytic stove is designed to reduce emissions, the conventional stove was believed to more representative of the burn conditions during the drill tower scenario.

Pine was selected because it is a cheaper wood, more things are constructed of pine wood, and during similar training scenarios, conducted at other facilities, old worn-out pallets constructed of pine were used as a fuel source (Van Gundy 2000). Since the elevation of the Ruston area is less than 350 feet (ft), results from the low altitude burns were used. The data from runs classified as low burn rates and high burn rates were obtained since the burn rate at the drill tower was unknown. In general, conditions that promote a fast burn rate and higher flame intensity enhance secondary combustion and thereby lower emissions. Conversely, higher emissions will result from a slow burn rate and lower flame intensity. The burning of 100 lb of wood in an hour's time translates into a burn rate of 45.4 kilogram (kg)/hr. Since the burn rates reported in USEPA (1990b) are between 1 kg/hr and 3 kg/hr, it is expected that the emission estimates from USEPA (1990b) would be an overestimate of those predicted for the drill tower scenario. Four sets of data were selected from USEPA (1990b) with the average used as the estimated emission factor. These emission factors (EMFs) are reported in Table 6 as grams of pollutant emitted per kg of wood burned.

Emission factors used to estimate emissions of VOCs and PAHs due to the burning of hay were obtained from *Atomospheric Pollutant Emission Factors from Open Burning of Agricultural and Forest Biomass by Wind Tunnel Simulations, Volume 1* (Jenkins *et al.* 1996). This study evaluated the potential emissions produced from the burning of a number of agricultural and forest products, including rice straw, wheat straw, barley straw, corn stover, and prunings of certain trees. Since the source material for the hay to be used during the drill tower training scenario was unknown, a surrogate had to be determined. For this assessment, wheat straw was selected as a surrogate for the hay because the results indicated it produced more total PAHs and contained larger EMFs for certain metals, arsenic, cadmium, and nickel, which can be major contributors to carcinogenic risk, and mercury, a major contributor to noncarcinogenic risk. Uncertainties related to the selection

Table 6 Emission Factors and Emission Estimates for Organic Compounds from the Burning of Wood

Chemical	Hourly Emission Rate (mg/hr)				Emission Factor (g/kg)[b]					Emission gm/sec
	SPLL-1[a]	SPLL-2[a]	SPLH-1[a]	SPLH-2[a]	SPLL-1[a]	SPLL-2[a]	SPLH-1[a]	SPLH-2[a]	Average[a]	
Polycyclic Aromatic Hydrocarbons										
naphthalene	189	438	426	857	1.14E-01	2.62E-01	1.84E-01	2.93E-01	2.14E-01	2.21E-04
acenaphthylene	148	336	356	210	8.92E-02	2.01E-01	1.54E-01	7.19E-02	1.29E-01	1.34E-04
acenaphthene	-	-	59	-	-	-	2.55E-02	-	2.55E-02	2.65E-05
fluorene	9	29	20	67	5.42E-03	1.74E-02	8.66E-03	2.29E-02	1.36E-02	1.41E-05
phenathrene	30	107	79	325	1.81E-02	6.41E-02	3.42E-02	1.11E-01	5.69E-02	5.90E-05
anthracene	5	14	13	51	3.01E-03	8.38E-03	5.63E-03	1.75E-02	8.62E-03	8.93E-06
fluoranthene	8	24	22	91	4.82E-03	1.44E-02	9.52E-03	3.12E-02	1.50E-02	1.55E-05
pyrene	11	26	25	113	6.63E-03	1.56E-02	1.08E-02	3.87E-02	1.79E-02	1.86E-05
Benzo[a]anthracene	14	36	17	82	8.43E-03	2.16E-02	7.36E-03	2.81E-02	1.64E-02	1.69E-05
chrysene	7	67	11	17	4.22E-03	4.01E-02	4.76E-03	5.82E-03	1.37E-02	1.42E-05
benzo[e]pyrene	4	23	9	32	2.41E-03	1.38E-02	3.90E-03	1.10E-02	7.76E-03	8.04E-06
benzo[b]fluoranthene	2	10	5	20	1.20E-03	5.99E-03	2.16E-03	6.85E-03	4.05E-03	4.20E-06
benzo[k]fluoranthene	1	1	2	7	6.02E-04	5.99E-04	8.66E-04	2.40E-03	1.12E-03	1.16E-06
benzo[a]pyrene	2	4	4	17	1.20E-03	2.40E-03	1.73E-03	5.82E-03	2.79E-03	2.89E-06
benzo[gih]perylene	1	9	1	19	6.02E-04	5.39E-03	4.33E-04	6.51E-03	3.23E-03	3.35E-06
dibenzo[ah]anthracene	-	-	4	5	-	-	1.73E-03	1.71E-03	1.72E-03	1.78E-06
indeno[123cd]pyrene	-	-	-	-	-	-	-	-	-	
Volatile Organic Compounds										
methane	3581	11581	3823	6265	2.16E+00	6.93E+00	1.65E+00	2.15E+00	3.22E+00	3.34E-03
ethane	254	2021	933	1175	1.53E-01	1.21E+00	4.04E-01	4.02E-01	5.42E-01	5.62E-04
ethylene	1333	5612	5167	6142	8.03E-01	3.36E+00	2.24E+00	2.10E+00	2.13E+00	2.20E-03

Table 6 (continued)

Chemical	Hourly Emission Rate (mg/hr)				Emission Factor (g/kg)[b]					Emission gm/sec
	SPLL-1[a]	SPLL-2[a]	SPLH-1[a]	SPLH-2[a]	SPLL-1[a]	SPLL-2[a]	SPLH-1[a]	SPLH-2[a]	Average[a]	
acetylene	299	1243	1245	2295	1.80E-01	7.44E-01	5.39E-01	7.86E-01	5.62E-01	5.82E-04
propane	57	524	179	145	3.43E-02	3.14E-01	7.75E-02	4.97E-02	1.19E-01	1.23E-04
propene	286	1798	1164	1453	1.72E-01	1.08E+00	5.04E-01	4.98E-01	5.63E-01	5.83E-04
I-butane	4	33	14	12	2.41E-03	1.98E-02	6.06E-03	4.11E-03	8.09E-03	8.37E-06
n-butane	9	62	63	17	5.42E-03	3.71E-02	2.73E-02	5.82E-03	1.89E-02	1.96E-05
butene	522	1576	1260	1594	3.14E-01	9.44E-01	5.45E-01	5.46E-01	5.87E-01	6.08E-04
pentene	143	560	281	260	8.61E-02	3.35E-01	1.22E-01	8.90E-02	1.58E-01	1.64E-04
hexane	129	714	336	433	7.77E-02	4.28E-01	1.45E-01	1.48E-01	2.00E-01	2.07E-04
benzene	1117	2697	2968	4209	6.73E-01	1.61E+00	1.28E+00	1.44E+00	1.25E+00	1.30E-03
toluene	329	1244	914	1521	1.98E-01	7.45E-01	3.96E-01	5.21E-01	4.65E-01	4.82E-04
furan	190	439	489	689	1.14E-01	2.63E-01	2.12E-01	2.36E-01	2.06E-01	2.14E-04
methyl ethyl ketone	60	408	176	150	3.61E-02	2.44E-01	7.62E-02	5.14E-02	1.02E-01	1.06E-04
2-methyll furan	1113	560	206	173	6.70E-01	3.35E-01	8.92E-02	5.92E-02	2.89E-01	2.99E-04
2,5 dimethyl furan	22	153	49	53	1.33E-02	9.16E-02	2.12E-02	1.82E-02	3.61E-02	3.74E-05
furfral	85	671	164	394	5.12E-02	4.02E-01	7.10E-02	1.35E-01	1.65E-01	1.71E-04
o-xylene	99	433	283	648	5.96E-02	2.59E-01	1.23E-01	2.22E-01	1.66E-01	1.72E-04

[a] - As defined in USEPA (1990b), Variables used:

SPLL (Scott stove, pine wood, low altitude, low burn rate)

SPLH (Scott stove, pine wood, low altitude, high burn rate)

[b] - Estimated by dividing the hourly emission rate by the burn rate .

of wheat straw over rice straw, barley straw, and corn stover is discussed in Section 4.4.1.3. Five sets of burns were conducted in the Jenkins *et al.* (1996) study for wheat straw with the results of these five tests presented in Table 7. These results were then averaged to determine an estimated emission factor. These EMFs are reported in Table 7 as mg of pollutant emitted per kg of hay burned.

Emission estimates for both wood and hay were calculated using Equation 5. As

$$\text{COC}\ \frac{\text{g}}{\text{s}} = \text{Wood/Hay}\ \frac{\text{lb}}{\text{yr}} \times \frac{0.454\ \text{kg}}{\text{lb}} \times \text{EMF COC}\ \frac{\text{g}}{\text{kg}} \times \frac{\text{yr}}{3.2 \times 10^{7}\ \text{s}} \qquad (5)$$

an example, using Equation 5, the consumption rate of hay (360,000 lb/yr) and a EMF of 0.145 g/kg for benzene from hay, an estimated emission rate of 7.5×10^{-4} g/s was calculated. The estimated emission rates (g/s) for all VOCs and PAHs for wood are listed in Table 6 and for hay in Table 7. These emission estimates were not measured during any formal emission tests performed at the facility but rather are intended to describe potential emissions resulting from combustion of wood and hay at the facility.

2.3.2 Estimates of Emissions of Inorganic Chemicals for the Drill Tower Scenario

The emission factors and emission estimates for the inorganic compounds that could potentially be released through the burning of hay and wood in the drill tower scenario were obtained in the same manner as the organic chemicals discussed in Section 2.3.1. The emission factors and emissions estimates for the inorganic compounds are listed in Table 8 for wood and Table 9 for hay.

Table 7 Emission Factors and Emission Estimates for Organic Compounds from the Burning of Hay

Chemical	8/11/92		8/13/92			Average Emission Factor	Emission g/s
	T1a	T2a	T1a	T2a	T3a		
Volatile Organic Compounds							
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg fuel	
Benzene	131	77	174	115	228	145.0	7.51E-04
Phenol	57	9	45	54	74	47.8	2.48E-04
Toluene	45	29	47	50	88	51.8	2.68E-04
Benzaldehyde	37	9	29	43	55	34.6	1.79E-04
Styrene	91	84	83	100	99	91.4	4.73E-04
Xylene	49	21	-	11	24	26.3	1.36E-04
Benzofuran	20	5	-	-	-	12.5	6.47E-05
Naphthalene	75	6	76	36	62	51.0	2.64E-04
Polycyclic Aromatic Hydrocarbons							
	µg/kg	µg/kg	µg/kg	µg/kg		mg/kg fuel	
Naphthalene	669311	26666	44736	44056		196.2	1.02E-03
Acenaphthylene	3572	618	702	1124		1.5	7.79E-06
Acenaphthene	-	27	260	393		0.2	1.17E-06
Fluorene	551	115	360	246		0.3	1.65E-06
Phenathrene	3372	2582	5653	4764		4.1	2.12E-05
Anthracene	1090	650	1322	1230		1.1	5.56E-06
Fluoranthene	1314	1095	7316	5992		3.9	2.04E-05
Pyrene	1121	1022	4474	3267		2.5	1.28E-05
Benz(a)anthracene	297	358	2364	2188		1.3	6.74E-06
Chrysene	447	377	2542	2109		1.4	7.09E-06
benzo(e)pyrene	144	221	1521	484		0.6	3.07E-06
benzo(b)fluorathene	506	136	2908	989		1.1	5.88E-06
benzo(k)fluorathene	274	326	790	533		0.5	2.49E-06
benzo(a)pyrene	237	78	1043	276		0.4	2.12E-06
benzo[ghi]-perylene	-	-	1070	1021		1.0	5.41E-06
indeno[1,2,3-cd]-pyrene	-	-	1160	186		0.7	3.49E-06
2-Methyl-naphthalene	508	981	657	2148		1.1	5.56E-06
perylene	-	16	302	996		0.4	2.27E-06

[a] - Indicates the date the sample was run and its run number as per Jenkins *et al.* (1996)
Note: µg indicates micrograms.

Table 8 Emission Factors and Emission Estimates for Inorganic Compounds from the Burning of Wood

Chemical	Hourly Emission Rate (mg/hr)				Emission Factor (g/kg)[b]					Emission gm/sec
	SPLL-1[a]	SPLL-2[a]	SPLH-1[a]	SPLH-2[a]	SPLL-1[a]	SPLL-2[a]	SPLH-1[a]	SPLH-2[a]	Average[a]	
Aluminum	0.416	2.583	2.951	1.009	2.51E-04	1.55E-03	1.28E-03	3.46E-04	8.55E-04	8.86E-07
Barium	-	7.985	3.524	6.339	-	4.78E-03	1.53E-03	2.17E-03	2.83E-03	2.93E-06
Cadmium	-	0.039	0.082	-	-	2.34E-05	3.55E-05	-	2.94E-05	3.05E-08
Calcium	0.416	4.815	2.951	2.449	2.51E-04	2.88E-03	1.28E-03	8.39E-04	1.31E-03	1.36E-06
Chromium	-	-	-	-	-	-	-	-	-	-
cobalt	-	-	-	-	-	-	-	-	-	-
Copper	-	0.157	0.164	-	-	9.40E-05	7.10E-05	-	8.25E-05	8.55E-08
Iron	-	0.352	0.41	0.144	-	2.11E-04	1.77E-04	4.93E-05	1.46E-04	1.51E-07
Lead	-	-	-	-	-	-	-	-	-	-
Magnesium	0.093	0.626	0.902	0.288	5.60E-05	3.75E-04	3.90E-04	9.86E-05	2.30E-04	2.38E-07
Manganese	-	0.117	0.082	0.144	-	7.01E-05	3.55E-05	4.93E-05	5.16E-05	5.35E-08
Nickel	-	0.039	-	0.144	-	2.34E-05	-	4.93E-05	3.63E-05	3.76E-08
Phosphorus	-	0.196	0.246	-	-	1.17E-04	1.06E-04	-	1.12E-04	1.16E-07
Potassium	3.655	16.166	17.458	14.696	2.20E-03	9.68E-03	7.56E-03	5.03E-03	6.12E-03	6.34E-06
Silver	-	-	-	-	-	-	-	-	-	-
sodium	1.573	29.945	28.113	13.399	9.48E-04	1.79E-02	1.22E-02	4.59E-03	8.91E-03	9.23E-06
Strontium	-	0.157	0.082	-	-	9.40E-05	3.55E-05	-	6.48E-05	6.71E-08
Tin	-	-	0.328	-	-	-	1.42E-04	-	1.42E-04	1.47E-07
Titanium	-	-	0.082	-	-	-	3.55E-05	-	3.55E-05	3.68E-08
Vanadium	-	-	-	-	-	-	-	-	-	-
Zinc	0.278	7.79	2.787	3.602	1.67E-04	4.66E-03	1.21E-03	1.23E-03	1.82E-03	1.88E-06

[a] - As defined in USEPA (1990b), Variables used: SPLL (Scott stove, pine wood, low altitude, low burn rate)
SPLH (Scott stove, pine wood, low altitude, high burn rate)

[b] - Estimated by dividing the hourly emission rate by the burn rate .

Table 9 Emission Factors and Emission Estimates for Inorganic Compounds from the Burning of Hay (mg/kg)

Chemical	11-Aug-92 PM10[a]	13-Aug-92 PM10[a]	Average PM10 mg/kg fuel	Emission gm/s
Aluminum	11.8541	8.7863	10.3202	5.35E-05
Silicon	20.8379	20.9675	20.9027	1.08E-04
Phosphorus	2.9711	4.2787	3.6249	1.88E-05
Sulfur	121.2102	83.2725	102.2414	5.30E-04
Chlorine	1206.0285	740.2276	973.1281	5.04E-03
Potassium	1067.6113	721.1228	894.3671	4.63E-03
Calcium	3.9833	3.751	3.8672	2.00E-05
Titanium	0.282	0.515	0.3985	2.06E-06
Vanadium	0.2115	0.0636	0.1376	7.12E-07
Chromium	0.1158	0.0445	0.0802	4.15E-07
Manganese	0.2266	0.2543	0.2405	1.25E-06
Iron	3.9581	6.6755	5.3168	2.75E-05
Cobalt	0.0353	-	0.0353	1.83E-07
Nickel	0.0655	0.0381	0.0518	2.68E-07
Copper	0.0755	0.0699	0.0727	3.77E-07
Zinc	0.7	0.426	0.5630	2.92E-06
Gallium	-	0.0572	0.0572	2.96E-07
Arsenic	-	0.0127	0.0127	6.58E-08
Selenium	0.0403	-	0.0403	2.09E-07
Bromine	5.1264	2.9118	4.0191	2.08E-05
Rubidium	0.4129	0.2098	0.3114	1.61E-06
Strontium	0.1058	0.0318	0.0688	3.56E-07
Yttrium	0.0504	0.0509	0.0507	2.62E-07
Zirconium	0.0101	0.0191	0.0146	7.56E-08
Molybdenum	0.1309	0.0636	0.0973	5.04E-07
Palladium	-	0.8011	0.8011	4.15E-06
Silver	0.8813	0.1653	0.5233	2.71E-06
Cadmium	0.841	0.9091	0.8751	4.53E-06
Indium	-	0.2734	0.2734	1.42E-06
Tin	-	0.534	0.5340	2.77E-06
Antimony	0.564	-	0.5640	2.92E-06
Barium	1.8683	-	1.8683	9.68E-06
Lanthanum	-	1.405	1.4050	7.28E-06
Gold	0.1914	0.0636	0.1275	6.60E-07
Mercury	0.0806	0.1971	0.1389	7.19E-07
Lead	0.1209	0.0954	0.1082	5.60E-07
Uranium	0.0151	-	0.0151	7.82E-08

[a] - Indicates the date the sample was run and its run number as per Jenkins *et al.* (1996)

2.3.3 Estimates of Emissions of Priority Pollutants for the Drill Tower Scenario

The MEFs used to estimate emissions of priority pollutants, PM, SO_x, NO_x, and CO from the combustion of wood were taken from Chapter 1, Section 9 of *Compilation of Air Pollutant Emission Factors, Volume 1, Stationary Point and Area Sources* (USEPA 1995a). This section of USEPA (1995a) provides estimates from the burning of wood in residential fireplaces and, although not specified, hardwood was probably used as the fuel source rather than pine. These emission factors are presented in Table 5. The emission factors taken from USEPA (1995a) are comparable to estimates for PM and CO from USEPA (1990b) of 148 g/kg (17% higher) and 10.9 g/kg (37% lower), respectively. Section 10 of USEPA 1995a also provided estimates for PM, SO_x, NO_x, and CO for the burning of wood (no specification as to the type of wood) in wood stoves. Emission factors in lb/ton from Section 10 were 15.3 (12% lower) for PM, 0.2 (no change) for SO_x, 1.4 (7% higher) for NO_x, and 115.4 (8% lower) for CO.

The MEFs used to estimate emissions from the combustion of hay for priority pollutants, PM, SO_x, NO_x, and CO were taken from *Atomospheric Pollutant Emission Factors from Open Burning of Agricultural and Forest Biomass by Wind Tunnel Simulations, Volume 2* (Jenkins *et al.* 1996). These values are presented in Table 5.

3.0 AIR QUALITY AND DEPOSITION MODELING

The combustion of materials produces residual amounts of pollution that may be released to the environment. Estimation of potential human health and environmental risks associated with these releases requires knowledge of atmospheric pollutant concentrations and annual deposition rates in the area of concern. The air concentrations and depositions are generally estimated using air dispersion models, which are mathematical constructs that approximate the physical processes occurring in the atmosphere that directly influence the dispersion of vapor and particulate emissions.

For this assessment, the latest versions of the Industrial Source Complex Short Term (ISCST3 Julian date 00101) air dispersion and deposition model (USEPA 1995b, USEPA 1995c) and the SCREEN3 model (USEPA 1995d) were used to estimate the air concentrations of vapors and particles, dry and wet deposition rates of particles, wet deposition rates of vapors, and acute air concentrations in the vicinity of the facility. These models, along with all support programs, are available for downloading from the Support Center for Regulatory Air Models (SCRAM) Internet site (http://www.epa.gov/SCRAM001).

3.1 Site-Specific Characteristics Required for Air Modeling

Before performing the air modeling, the area surrounding the facility was evaluated to determine the elevation of the surrounding land surface, identify the type of land uses and land cover in the area, select an appropriate watershed for modeling exposure to COCs through fish ingestion, and identify buildings that may affect the dispersion of COCs.

3.1.1 Surrounding Terrain Information

United States Geological Survey (USGS) topographic maps (USGS 1994a-b, 1985a-b) were reviewed to determine the elevation of the surrounding terrain. The elevation at the facility is approximately 240 ft above sea level. The elevation within a study area of a 6 km radius around the facility ranges between 135 and 340 ft. Therefore, the terrain is sufficiently variable that the flat terrain option of the ISCST3 model could not be used and elevation information was required for each of the air modeling receptor nodes. Using the topographic maps, the elevation of each air modeling receptor node was recorded for use.

A Cartesian receptor grid's origin was placed roughly at the center of the three training scenario hypothetical locations. USEPA Guidance (1994a) recommends that air modeling be performed out 10 km in each direction. However, because the combustion sources used at the training facility are in close proximity to ground level and a variable terrain grid was selected, most of the deposition will occur within the 6 km grid. Therefore, the air modeling for this analysis was performed out to 6 km in each direction only. A 12 km by 12 km grid consisting of three levels of resolution was used to define the receptor grid. A 100 meter (m) spacing was used from 0 to 1 km from origin, with a spacing of 500 m from 1 to 3 km, and 1 km from 3 to 6 km from the origin.

3.1.2 Surrounding Land Use Information

3.1.2.1 Land Use for Dispersion Coefficients. The topographic maps (USGS 1994a-b, 1985a-b), which include symbols for permanent structures, were inspected in order to classify the land use as rural or urban. Since very few structures indicated were on the maps of the surrounding area, the land use was determined to be rural. A site visit was also made to verify the accuracy of the topographic maps. Although additional structures may be constructed near the site in the future, it was determined that based upon the facility's location, the rural classification would be justified for future scenarios.

3.1.2.2 Land Use for Surface Roughness Height (Length). The surface roughness length calculation is based on the type of land cover and the season. Table 10 is the seasonal division used to characterize the warm climate in the Ruston area. The type of land cover was determined to consist primarily of coniferous forest and grassland through the inspection of topographical maps and the site visit. For the purposes of this analysis, the assumption was made that the type of land cover in the area was 75% coniferous forest, 15 % grassland, 5% cultivated land, and 5% deciduous forest. All other land use categories, water surface, swamp, urban, and desert shrubland, were assigned a value of 0 and therefore did not contribute to the determination of the surface roughness height. The surface roughness height for the hypothetical site is given for each season in Table 11 (USEPA 1998a). The surface roughness height was calculated by weighting the values in Table 11 according to the length of each season given in Table 10. The frequency distribution of the wind also affects the overall surface roughness height. However, in this case, because the percentages for the land use categories were the same in all directions surrounding the facility, the wind frequency distribution has no effect. Using the above method, a value of 1.04 m was determined for the surface roughness height.

Table 10. Seasonal Divisions for the Ruston, Louisiana Area

Season	Months	Percent
Spring	4	33
Summer	5	42
Winter	0	0
Fall	3	25

Table 11. Surface Roughness Height by Land Cover and Season (meters)

Land Cover	Site Area (%)	Surface Roughness Height				
		Spring	Summer	Autumn	Winter	Overall[a]
Water Surface	0	0.0001	0.0001	0.0001	0.0001	0
Deciduous Forest	5	1	1.3	0.8	0.5	0.05
Coniferous Forest	75	1.3	1.3	1.3	1.3	0.98
Swamp	0	0.2	0.2	0.2	0.05	0
Cultivated Land	5	0.03	0.2	0.05	0.01	0.01
Grassland	15	0.05	0.1	0.01	0.001	0.01
Urban	0	1	1	1	1	0
Desert Shrubland	0	0.3	0.3	0.3	0.15	0
Total						1.04

[a] - Overall surface roughness height was determined by multiplying the percent seasonal distribution from Table 10 by the roughness height for each season, summing those results, and multiplying that sum by the percent of land cover for the site.

3.1.2.3 Identification of Surrounding Watershed Area. No waterbodies within the study area could support a subsistence fisher. In order to evaluate the hypothetical subsistence fisher, "Selected" Creek was chosen as the watershed with the highest potential to be impacted by emissions from the facility. This creek was selected because of its close proximity to the facility and because its watershed area is located in the predominate wind direction (i.e., the downwind direction). The predominant wind direction was determined by inspection of a wind rose plot as shown in Figure 5, which was derived from the area-specific meteorological data. An area in the path of the predominant wind direction, and hence, the maximum contamination, was selected as a representative watershed. The use of a representative watershed, as opposed to the entire watershed of the waterbody under consideration, generally results in a more conservative prediction of contamination since the average deposition value is not diluted by distant areas of the watershed. A review of the air modeling results indicated that very little deposition occurred outside a 3 to 4 km radius from the facility. Therefore, the representative watershed evaluated in this assessment was assumed to be in the predominant wind direction and within 4 km of the facility. Demarcation of the watershed was based upon the elevation contours on the USGS topographic maps. The representative watershed selected for the "Selected" Creek is indicated in Figure 6.

3.1.2.4 Information on Facility Building Characteristics. Since this is a hypothetical facility, no accurate determination as to building downwash influence could be determined. Due to the close proximity of the maximum off-site receptor locations selected, it is unlikely that the inclusion of building downwash influence on the plume would have resulted in higher off-site concentrations or depositions than those predicted in this air modeling exercise.

3.2 Use of Unit Emission Rate

A unit emission rate [1 g/s] was used for each training scenario location. The values obtained with the unit emission rate were adjusted to chemical-specific air concentrations and depositicn rates using chemical-specific emission rates. Since the relationship between

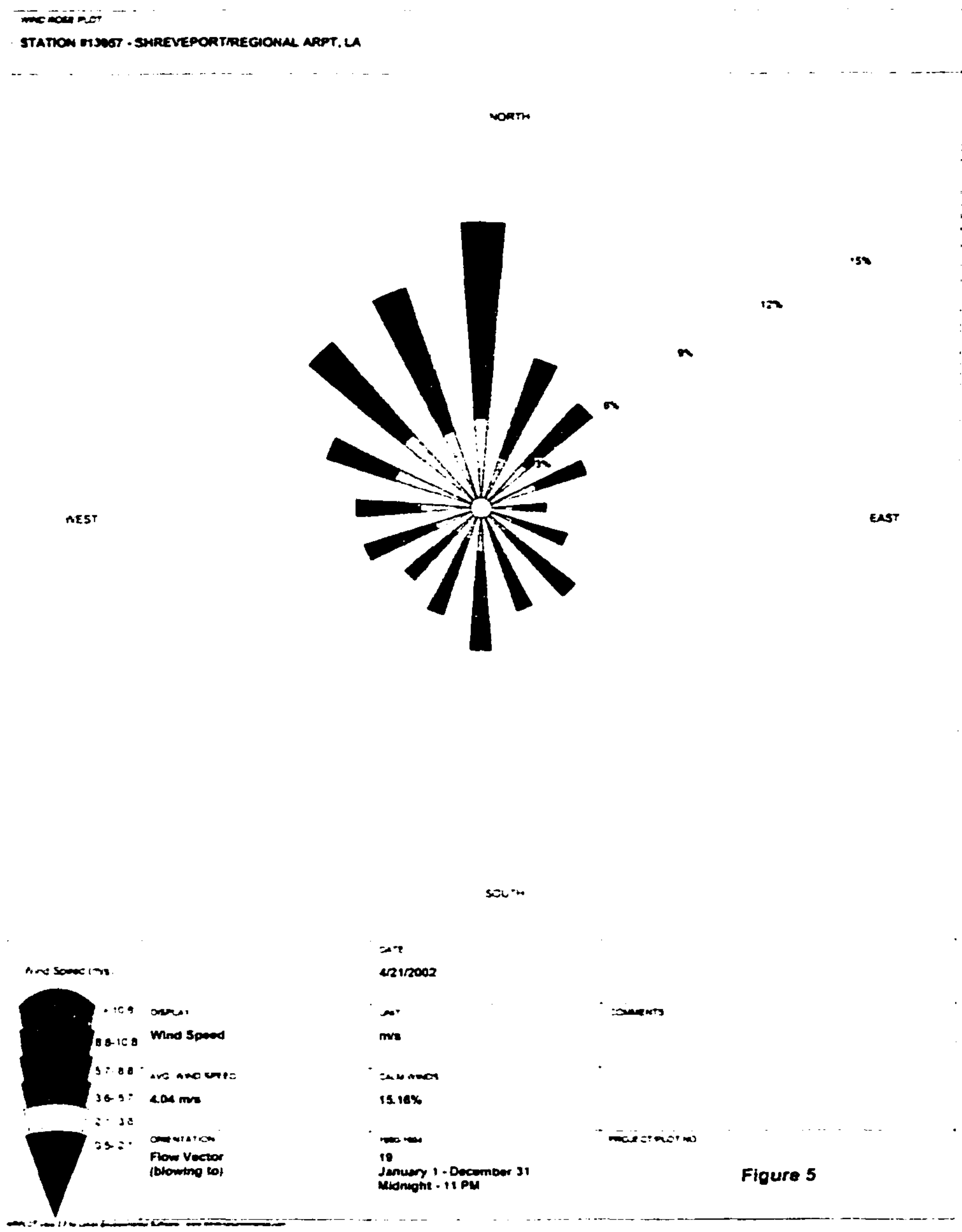
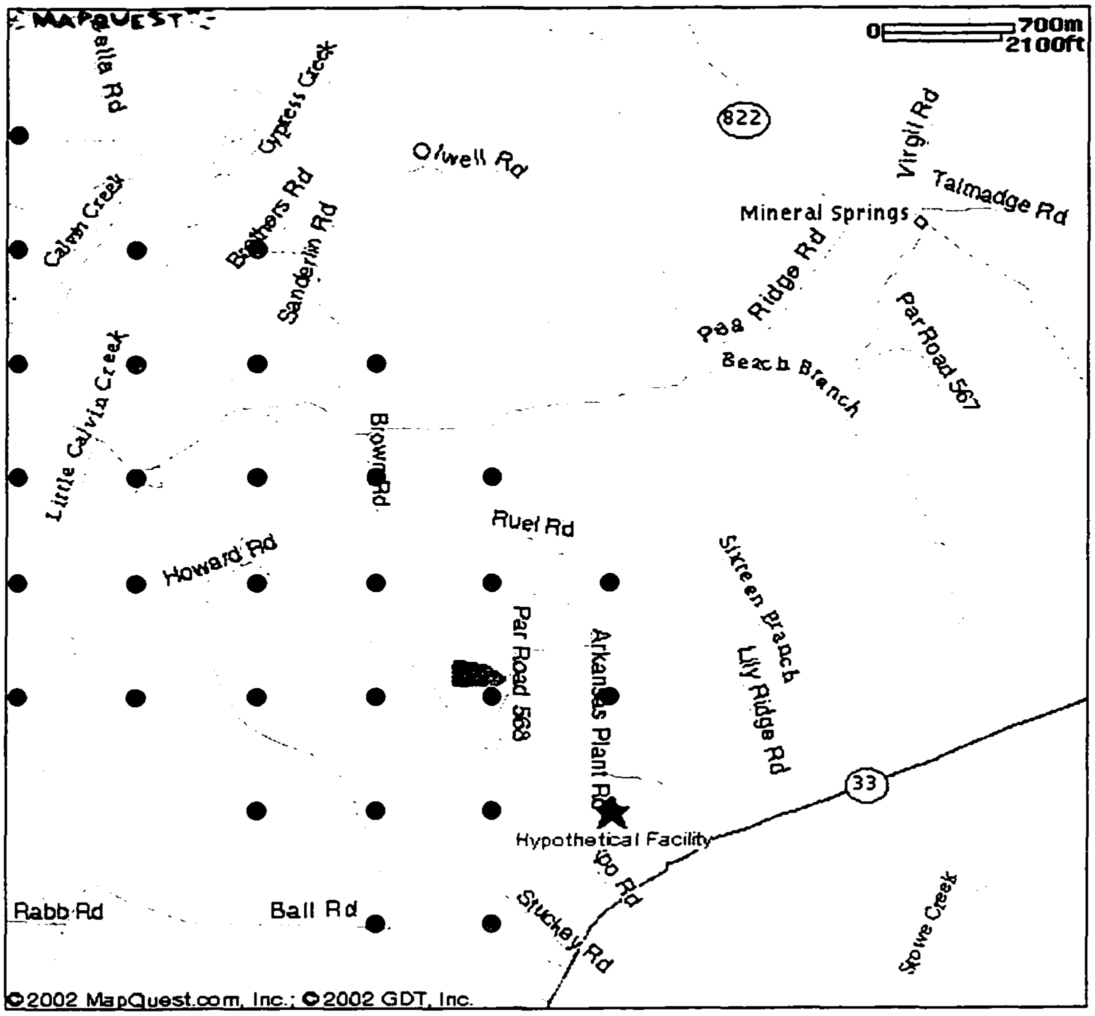


Figure 5. Wind Rose Plot for Station 13957 –
Shreveport Region Airport, LA Site



● Watershed Receptor

Figure 6 "Selected Creek Watershed Receptor Grid emissions and air concentrations and deposition rates is linear, chemical-specific concentrations and deposition rates can be obtained using the following equations:

$$\frac{Chemical\ Deposition\ Rate\ (g/m^2{\cdot}yr)}{Chemical\ Emission\ Rate\ (g/s)} = \frac{Modeled\ Deposition\ Rate\ (g/m^2{\cdot}yr)}{Unit\ Emission\ Rate\ (1\ g/s)} \qquad (6)$$

and

$$\frac{Chemical\ Air\ Conc.\ (\mu g/m^3)}{Chemical\ Emission\ Rate\ (g/s)} = \frac{Modeled\ Air\ Conc.\ (\mu g/m^3)}{Unit\ Emission\ Rate\ (1\ g/s)} \qquad (7)$$

Since the unit emission rate equals 1 g/s, the air model output is also a unitized yearly air concentration, which when multiplied by the emission rate in g/s provides the chemical-specific value as in the following equation:

$$Air\ Conc.\ (\mu g/m^3) = Unitized\ Air\ Conc.\ (\mu g{\cdot}s/g{\cdot}m^3) \cdot Emission\ Rate\ (g/s) \qquad (8)$$

Similarly, chemical-specific deposition is calculated as follows:

$$Dep\ Rate\ (g/m^2{\cdot}yr) = Unitized\ Dep\ Rate\ (s/m^2{\cdot}yr) \cdot Emission\ Rate\ (g/s) \qquad (9)$$

3.3 Partitioning of Emissions

Three different model run types for each training scenario location were required to obtain estimated parameter values for the vapor phase, particle phase, and particle bound.

3.3.1 Vapor Phase Modeling

Output from the vapor phase modeling is the ambient air concentration and wet vapor deposition based on the unit emission rate at each of the receptor grid nodes. No particle size distribution data were required for vapor phase modeling.

3.3.2 Particle Phase Modeling (Mass Weighting)

The rate at which dry and wet removal processes deposit particulate-phase COCs to the earth's surface is computed within the ISCST3 program. The particle size in millimeters (mm) determines the fate of the particles in the air flow and along with the particle density, determines the particles terminal (falling) velocity. Wet deposition also depends on particle size with the larger particles being more easily removed by falling liquid or frozen precipitation. Therefore, particle size distributions had to be determined for the combustion materials at each location, or else the default distribution shown in Table 12 was used. The default distribution in Table 12 is recommended in USEPA (1998a) when experimental measurements are not available.

At the drill tower, hay and wood will be burned. Since no particle size distribution data could be located for the burning of hay and wood, the USEPA default distribution in Table 12 was used.

At the ARFF training area, diesel fuel, gasoline, aviation fuel, and kerosene will be burned. Since these fuels are of the same type of material, hydrocarbon fuels, a common distribution was used. Experimental measurements of diesel engine particle emissions (Table 13), have shown that 50% (by mass) of the particle exhaust emissions are less than 0.30 μm in diameter, and 90% (by mass) are less than 1 μm in diameter (Nauss 1997).

Table 12. Default Particle Size Distribution

1	2	3	4	5	6
Mean Particle Diameter (μm)	Particle Radius (μm)	Surface Area/Volume (μm^{-1})	Fraction of Total Mass	Proportion Available Surface Area	Fraction of Total Surface Area
> 15.0	7.50	0.400	0.128	0.0512	0.0149
12.5	6.25	0.480	0.105	0.0504	0.0146
8.1	4.05	0.741	0.104	0.0771	0.0224
5.5	2.75	1.091	0.073	0.0796	0.0231
3.6	1.80	1.667	0.103	0.1717	0.0499
2.0	1.00	3.000	0.105	0.3150	0.0915
1.1	0.55	5.455	0.082	0.4473	0.1290
0.7	0.40	7.500	0.076	0.5700	0.1656
< 0.7	0.40	7.500	0.224	1.6800	0.4880

These data were chosen to represent each of the hydrocarbon fuels burned. Since the data was given in the form of cutoff diameters accounting for a certain percentage of the total mass, the mean particle diameters were determined as discussed in USEPA (1998a, 1997) using Equation 10.

$$D_{mean} = \left[\, 0.25 \cdot \left(D_1^3 + D_1^2 D_2^1 + D_1^1 D_2^2 + D_2^3 \right) \right]^{0.33} \qquad (10)$$

where: D_{mean}=mean particle diameter for the particle size category (μm)
D_l=lower bound cut of the particle size category (μm)
D_2=upper bound cut of the particle size category (μm)

A value of 0 for D_l was used in determining the smallest mean particle diameter.

For the propane system, propane gas will be burned. It is assumed that the particle size distribution, both the size of the particle and the range of the particles, resulting from propane combustion to be small compared with the particle size distribution resulting from diesel fuel combustion. Therefore, the particle size distribution shown in Table 13 was also

Table 13. Particle Size Distribution of Petroleum Fuel Emissions

1	2	3	4	5	6
Mean Particle Diameter (μm)	Particle Radius (μm)	Surface Area/Volume (μm^{-1})	Fraction of Total Mass	Proportion Available Surface Area	Fraction of Total Surface Area
> 1.0	0.50	6.00	0.10	0.600	0.0316
0.71	0.36	8.45	0.40	3.380	0.1780
0.19	0.10	31.22	0.50	15.612	0.8220

used for the propane system. Use of this particle size distribution will result in increased deposition near the facility which will increase the dry and wet deposition values predicted by ISCST3.

3.3.3 Particle Bound Modeling (Surface Area Weighting)

For the particle bound modeling, a surface area weighting instead of a mass weighting of the particles was required. Holding the density of the particle constant, the portion of available surface area of aerodynamic spherical particles is the ratio of the surface area ($4\pi r^2$) to the volume ($1.33\pi r^3$). Column 3 in Tables 12 and 13 presents this ratio. This value is then multiplied by the fraction of total mass (column 4) to determine the proportion of available surface area (column 5). Summing of column 5 yields the total surface area of all the particles in the distributions. The fraction of total surface area (column 6) for each particle diameter is determined by dividing this sum into each particle diameter's proportion available surface area.

3.4 Meteorological Data

For the creation of the meteorological file, it was necessary to obtain regional meteorological data for surface meteorological data, upper air (mixing height) meteorological data, and precipitation data. The surface and precipitation data were obtained from the National Climatic Data Center (NCDC) for the years 1990, 1991, 1992, 1993, and 1994. The surface meteorological information was measured at the National Weather Service's (NWS) Shreveport Regional Airport site (Station 13957). The upper air data was obtained from the upper air station in Longview, Texas (Station 03951) for the same years. The upper air station was moved to Shreveport, Louisiana in March 1995 but this movement did not overlap with any of the selected years. Data were gathered for 1990-1994 because they were the most recent set of years with both surface and upper air data available for the area. Data more recent than 1994 was not used because the weather station had been automated in 1995, and many of the variables used in the air modeling were no longer collected. The data were verified for completeness and modifications to missing data made according to USEPA guidelines (Atkinson and Lee 1992). Precipitation data was also obtained from the NCDC for the Shreveport area for the same years.

3.5 Meteorological Preprocessor Program

The preprocessor PCRAMMET (USEPA 1995e) was used to prepare the NWS data for use in the ISCST3 model for each year. A command file, used as input to the PCRAMMET program, was created. An example of the PCRAMMET control file is shown in Figure 7.

The 'W' in line 1 of Figure 7 indicates that both wet and dry deposition calculations are to be made by the model when using the meteorological file. Lines 2 and 3 of the PCRAMMET control file specify the filenames containing the upper air data and hourly

1	W	No/Dry/Wet Deposition calculations
2	03951-90.txt	Mixing height data file
3	90.dat	Hourly surface data file
4	CD144	Surface data format
5	32.467	Station latitude (decimal degrees)
6	93.817	Station longitude (decimal degrees)
7	6	Station time zone
8	shvp_fix.90p	Precipitation data file
9	FIXED	Precipitation data file type
10	2.000	Min. Obukhov length (m)
11	10.0	Anemometer height (m)
12	0.1000	Roughness length (m), measurement site
13	1.0400	Roughness length (m), application site
14	0.132	Noon time albedo
15	0.580	Bowen ratio
16	0.000	Anthropogenic heat flux (W/m^2)
17	0.150	Fraction net rad'n absorbed by ground

Figure 7. PCRAMMET Input File

surface data, respectively. Line 4 indicates the surface data format, which is CD144 indicating that the data were obtained from the NCDC. The next three lines, 5 to 7, indicate the latitude, longitude, and time zone of the surface station. Line 8 and 9 are the precipitation data filename and its format. The minimum Monin-Obukhov length is specified in line 10 of the control file. As suggested in the PCRAMMET manual (USEPA 1995e, page 3-6) the minimum Monin-Obukhov length value for open land is 2 m. The anemometer height is specified in line 11, followed by the roughness heights in lines 12 (USEPA default value) and 13 (derivation discussed in Section 3.1.2.2), noon-time albedo in line 14 and Bowen ratio in line 15. The noon-time albedo and Bowen ratio were calculated in the same manner as the surface roughness height using the values listed in Table 14 and Table 15, respectively. The Bowen ratio was determined using the average conditions table presented in USEPA 1995e. Since the area being modeled is considered rural, the anthropogenic heat flux in line 16 was set to zero. The recommended default value of 0.15 for rural areas (USEPA 1998a) was used for the fraction of net radiation absorbed at the ground in line 17.

3.6 ISCST3 Model Input Files

Separate ISCST3 runs were required to model the vapor phase, particle bound, and particle phase for the chemicals for each of the emission sources. The five years of meteorological data were combined into one data file so that all five years were run at the same time.

Table 14. Albedo for Land Use Types and Seasons

Land-Use	Spring	Summer	Autumn	Winter	Average[a]
Water Surface	0.12	0.10	0.14	0.20	0
Deciduous Forest	0.12	0.12	0.12	0.50	0.01
Coniferous Forest	0.12	0.12	0.12	0.35	0.09
Swamp	0.12	0.14	0.16	0.30	0
Cultivated Land	0.14	0.20	0.18	0.60	0.01
Grassland	0.18	0.18	0.20	0.60	0.03
Urban	0.14	0.16	0.18	0.35	0
Desert Shrubland	0.30	0.28	0.28	0.45	0
Total					0.131

[a] - Average determined by multiplying the column value by the appropriate seasonal distribution value in Table 10 and dividing the sum of all four season values by 12, the number of months per year.

The control file is an American Standard Code for Information Exchange (ASCII) file which contains the information that provides the overall control of the model run and includes the model option settings, source parameters, and receptor locations. The modeling options were selected following the *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities* (USEPA 1998a), *Guideline on Air Quality Models (Revised)* (USEPA 1995f), the *Guidance for Performing Screening Level Risk Analyses at*

Table 15. Daytime Bowen Ratio for Land Use Types and Seasons 1985

Land-Use	Spring	Summer	Autumn	Winter	Average[a]
Water Surface	0.1	0.1	0.1	1.5	0
Deciduous Forest	0.7	0.3	1	1.5	0.03
Coniferous Forest	0.7	0.3	0.8	1.5	0.42
Swamp	0.1	0.1	0.1	1.5	0
Cultivated Land	0.3	0.5	0.7	1.5	0.02
Grassland	0.4	0.8	1	1.5	0.11
Urban	1	2	2	1.5	0
Desert Shrubland	3	4	6	6	0
Total					0.581

[a] - Average determined by multiplying the column value by the appropriate seasonal distribution value in Table 10 and dividing the sum of all four season values by 12, the number of months per year.

Combustion Facilities Burning Hazardous Wastes (USEPA 1994a), and comments supplied by USEPA (1997).

The control file makes use of the following "pathways":

- control pathway - specifies whether the model calculates deposition rates or air concentration;

- source pathway - contains a description of the facility-specific emission sources and building information, including source type, location, height, diameter, exit temperature, and exit velocity and any required particle size distributions are also specified in the source pathway;

- receptor pathway - defines the receptor locations and elevations for the model run;

- meteorological pathway - used to identify the name of the meteorological input file and specify any additional meteorological information that is not contained in the input file;

- output pathway - sets up the tables of maximum air concentration or deposition rate values and of values for each receptor; and

- terrain pathway - contains elevation values for the source and intervening terrain.

3.6.1 Control Pathway

The control pathway (identified by the program using the mnemonic CO) is used to specify whether the model calculates deposition rates or air concentrations. The control pathway section of the vapor phase control file for the drill tower is displayed in Figure 8.

```
CO STARTING
  TITLEONE   Fire Station : Vapor : Burning tower three times per day
  TITLETWO  (CYV DYWV CHV)
  MODELOPT  DFAULT CONC WDEP WETDPLT RURAL
  AVERTIME  1 ANNUAL
  TERRHGTS  ELEV
  POLLUTID  OTHER
  RUNORNOT  RUN
  SAVEFILE  f1.SAV 5 f2.SAV
** Uncomment the INITFILE command and rename f1.SAV in
**  the SAVEFILE command if the run crashes.
**   INITFILE  f1.SAV
  ERRORFIL  Vtower.ERR
CO FINISHED
```

Figure 8. Control Pathway for Drill Tower

All lines are identical for each run for each source except for the title lines (TITLEONE and TITLETWO), the MODELOPT line, and the ERRORFIL line. The MODELOPT keyword in the CO pathway is used for changing the type of model output desired (additional information contained in the source pathway also controls the type of model output). The MODELOPT line is modified for the different runs as listed below:

Vapor:	DFAULT CONC WDEP WETDPLT RURAL
Particle Phase:	DFAULT CONC DDEP WDEP DEPOS DRYDPLT WETDPLT RURAL
Particle Bound:	DFAULT CONC DDEP WDEP DEPOS DRYDPLT WETDPLT RURAL

The DFAULT parameter in the MODELOPT keyword indicates that USEPA defaults are to be used during the model run. The USEPA defaults are

- use stack-tip downwash (except for Schulman-Scire downwash),
- use buoyancy-induced dispersion (except for Schulman-Scire downwash),
- do not use gradual plume rise (except for building downwash),
- use the calms process routines,
- use upper-bound concentration estimates for sources influenced by building downwash from super-squat buildings,
- use default wind speed profile exponents, and
- use default vertical potential temperature gradients.

Note that the stack-tip downwash is not applicable to volume sources used in the modeling of the ARFF and drill tower scenarios. While it is applicable to the point source used to model the propane system (see section 3.6.2.3), calculations of the downwash using equation 1-7 of USEPA (1995c) resulted in a change less than or equal to 1.6×10^{-6} m.

Lines that begin with '**' are comments and are ignored during execution. The RURAL in the MODELOPT keyword indicates that the rural dispersion parameters will be used during modeling as opposed to the urban parameters. The AVERTIME parameter was set to both 1 and annual indicating that both an hourly value and an annual average value were to be determined at each receptor node. The TERRHGTS parameter value of ELEV indicated that an elevated terrain option was being used. The POLLUTID parameter was set to other, which indicated no internal corrections were to be performed. The RUNORNOT parameter was set to RUN. The SAVEFILE parameters are the names of two temporary files and a number that specifies the number of years to process before updating the temporary files. These files are used to restart the model in case the execution is interrupted. The ERRORFIL parameter was set to the name of a file in which any error messages were stored.

3.6.2 Source Pathway

The source pathway (mnemonic SO) contains the facility-specific source parameters and building information. The source pathway information of the vapor phase control file for the drill tower is displayed in Figure 9. The source pathway information of the particle phase control file for the drill tower, ARFF, and propane system scenarios are displayed in Figures 10, 11, and 12, respectively.

The LOCATION keyword identifies the source name, type, location, and base elevation. The common types of sources are point, volume, and area. The location is expressed in Universal Transverse Mercator (UTM) coordinates. The elevation is expressed in meters above sea level.

```
** Tower training (wood, straw, propane starter).
  LOCATION Tower VOLUME 434160 3063110 164.592
  EMISFACT Tower HROFDY 8*0.0 1.0 2*0.0 1.0 2*0.0 1.0 9*0.0
  SRCPARAM Tower   1     12.2     2.5   5.7

** The following 2 lines are only used for vapor phase modeling.
  GAS-SCAV Tower  LIQ  1.7e-4
  GAS-SCAV Tower  ICE  0.6e-4
  SRCGROUP ALL
SO FINISHED
```

Figure 9. Vapor Phase Source Pathway for Drill Tower

```
** Tower training (wood, straw, propane starter).
  LOCATION Tower VOLUME 434160 3063110 164.592
  EMISFACT Tower HROFDY 8*0.0 1.0 2*0.0 1.0 2*0.0 1.0 9*0.0
  SRCPARAM Tower   1    12.2    2.5   5.7
** The following 5 lines are used only for particle and particle bound contaminant
modeling.
  PARTDIAM Tower 0.700 0.700 1.100 2.000 3.600 5.500 8.100 12.50 15.00
  MASSFRAX Tower 0.224 0.076 0.082 0.105 0.103 0.073 0.104 0.105 0.128
  PARTDENS Tower 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000
  PARTSLIQ Tower 4.0e-5 4.0e-5 5.0e-5 1.4e-4 2.6e-4 3.9e-4 5.1e-4 6.6e-4 6.6e-4
  PARTSICE Tower 1.3e-5 1.3e-5 1.7e-5 4.7e-5 8.7e-5 1.3e-4 1.7e-4 2.2e-4 2.2e-4
  SRCGROUP ALL
SO FINISHED
```

Figure 10. Particle Phase Source Pathway for Drill Tower

```
SO STARTING

** ARFF training (kerosene, avgas, diesel, gasoline).
  LOCATION Plane VOLUME 434300 3063030 164.592
  EMISFACT Plane HROFDY 11*0.0  1.0  12*0.0
  SRCPARAM Plane   1    40    11.5    11.5
** Particle size based 0.03 for median mass diameter
** 1.0 for 90th percentile of mass.
  PARTDIAM Plane 0.192 0.710 1.000
  MASSFRAX Plane 0.500 0.400 0.100
  PARTDENS Plane 1.000 1.000 1.000
  PARTSLIQ Plane 1.3e-4 4.0e-5 4.0e-5
  PARTSICE Plane 4.3e-6 1.3e-5 1.3e-5

  SRCGROUP ALL
SO FINISHED
```

Figure 11. Source Pathway for ARFF Particulates

```
SO STARTING
  LOCATION Prop POINT 434200 3063100 164.592
  EMISFACT Prop HROFDY 8*0.0  8*1.0  8*0.0
  SRCPARAM Prop  1  1  1273  20  0.021
  PARTDIAM Prop 0.192 0.710 1.000
  MASSFRAX Prop 0.500 0.400 0.100
  PARTDENS Prop 1.000 1.000 1.000
  PARTSLIQ Prop 1.3e-4 4.0e-5 4.0e-5
  PARTSICE Prop 4.3e-6 1.3e-5 1.3e-5

  SRCGROUP ALL
SO FINISHED
```

Figure 12. Source Pathway for Propane System Particulates

The EMISFACT keyword describes the amount and frequency of emission from the source. The frequency classification used for this facility is HROFDY, in which an emission rate is specified for each hour of the day.

The SRCPARAM parameters describe the particular source type chosen in the LOCATION line. For point sources, the parameters include the emission rate, source height, source temperature, source exit velocity, and source diameter. For a volume source, the parameters include the emission rate, the initial vertical dispersion coefficient, the initial horizontal dispersion coefficient, and the effective release height.

The GAS-SCAV parameters shown in Figure 10 describe the empirical scavenging coefficients used by the model to compute wet deposition of vapors. The coefficient due to liquid precipitation is preceded by the parameter LIQ and the frozen precipitation coefficient is preceded by the parameter ICE. For vapor phase calculations, the coefficients are assumed to be equal to the coefficients for a 0.1 μm particle.

When modeling particulate and particulate bound deposition, additional keywords describing the particle size and mass distributions are required (See Tables 12 and 13). The PARTDIAM parameters are a list of particle diameters in micrometers that make up the plume. When modeling particle phase pollutants, the MASSFRAX parameters are the mass fractions of the corresponding particle sizes listed in PARTDIAM. When modeling particle bound pollutants, the MASSFRAX parameters are the fractions of the total surface area of the corresponding particle sizes listed in PARTDIAM. The PARTDENS parameters are the particle densities corresponding to the particle sizes listed in PARTDIAM. The densities are assumed to be 1.0 g/cm^3 for all sizes of particles as suggested by USEPA (1998a). This may be a conservative estimate since particles from combustion sources may have densities that are less than 1.0 g/cm^3 (USEPA 1994b). The PARTSLIQ parameters are the liquid precipitation scavenging coefficients determined from a best fit curve based on the work of Jindal and Heinhold (USEPA 1995c). The PARTSICE parameters are the frozen liquid precipitation scavenging coefficients. The value for the frozen vapor phase scavenging factor was assumed to be one-third of the PARTSLIQ parameters as per EPA Guidance (USEPA 1997).

The line "SRCGROUP ALL" is a mandatory keyword used to combine the contaminant concentrations from all sources into one value for each receptor node.

3.6.2.1 Source Pathway Information for the ARFF Scenario. It was assumed that during the ARFF training, a mock airplane would be wetted with kerosene, aviation fuel, diesel fuel, and gasoline, and ignited in the open. It was further assumed that the fire would be approximately 2.5 m in radius. The plume was modeled as a volume type source with dimensions dependent on the magnitude of plume rise that results. The airplane was assumed to be at UTM coordinates 538400 East and 3608000 North, which is 100 m west of the center of the Cartesian receptor grid. A base elevation of 240 ft (73 m) was estimated from the topographical maps.

The emission rate was divided into an amount for each hour of the day. It was assumed that the materials were burned once per day, for one hour at 1200 hours Central Standard Time (CST). This time was chosen because it was the middle of the workday. To be conservative, this method for characterizing the release was chosen even though it assumes that the events occur on weekends as well.

The formulas used by the ISCST3 model for calculating the plume rise from a smoke stack are semi-empirical formulas. As a result, buoyant plume rise formulas have been parameterized in terms of easily obtainable point source stack parameters, such as stack temperature and stack gas exit velocity. However, the temperature of the burning airplane was not known and the exit velocity would be essential zero. Therefore, instead of using a point source to model the burning airplane, the plume rise and buoyancy induced dispersion were computed using the methods outlined in Bjorklund *et al.* (1998). This approach is based on the fuels' heats of combustion and burning rates instead of temperature and exit velocity. The smallest plume rise, 40 m, was computed for kerosene. This plume rise was used to represent the release height used in the model.

The initial horizontal and vertical dispersion coefficients were first calculated according to USEPA (1995c), where the length of the side was taken to be 2.5 m and the vertical dimension was taken to be 2.5 m. The coefficients were then adjusted to account for buoyancy induced dispersion using equations (1-48) and (1-49) in USEPA (1995c).

Several measures were taken to ensure that the plume rise would not be overestimated and hence underestimate the contamination at ground level. The calculation was performed under both stable and neutral or unstable conditions and the lesser value was chosen. The calculation was performed with a wind speed of 10 m/s, which is over twice as strong as the actual mean wind speed of 4.04 m/s. This value for the wind speed was chosen because for the 5-year period covered by the meteorological data, the fraction of wind speeds recorded that were greater than 10.8 m/s was only 0.001.

Since all of the fuels are hydrocarbon fuels, the particle size distribution for the fuel was assumed to be approximately that of diesel fuel. For a description of the derivation of the particle size parameters, see section 3.3.2. The parameters are shown in Table 13.

3.6.2.2 Source Pathway Information for the Propane System Scenario. It was assumed that the propane would be released from a upward-pointing valve and then ignited in the open. The source was modeled as a flare release point source using parameters obtained from the SCREEN3 User's Guide (USEPA 1995d). The propane system was assumed to be located at UTM coordinates 538600 East and 3608000 North, which is 100 m East of the center of the Cartesian receptor grid. A base elevation of 240 ft (73 m) was estimated from the topographical maps.

The propane system is expected to be burned twenty five times per day. Since it is burned frequently, it was treated as a continuous release source burning from 0800 to 1600 hours CST.

The method described in the Screen3 User's Guide (USEPA 1995d) for flare sources was used to determine the source parameters. This method assumes a release temperature of 1273 K, an exit velocity of 20 m/s, and an effective release diameter computed from the heat-release rate. The effective diameter is given by $d_e = 9.88\times 10^{-4}\cdot(Q_H)^{0.5}$, where $Q_H = 0.45\cdot H$ is the sensible heat release rate and H is the total heat release rate. The total heat release rate was approximated by $A\cdot(\Delta h_c^2/\Delta h_v)\times 10^{-3}$, where A is the area of the fire, Δh_c is the lower heat of combustion, and Δh_v is the latent heat of vaporization (Bagster and Pitblado 1989). Assuming that the fire area is $\pi/4$, the heat of combustion is 12058 cal/g (Weast 1978), and the latent heat of vaporization is 109.36 cal/g (Weast 1978) yields 0.021 m for the effective diameter.

The particle size distribution resulting from the propane training scenario is expected to be somewhat smaller than the ARFF training scenario. As a conservative estimate, however, the same particle size distribution was used for the propane system as for the ARFF fuels (See Table 13).

3.6.2.3 Source Pathway Information for the Drill Tower Scenario.

The tower was assumed to be at UTM coordinates 538500 East and 3608000 North, which is at the center of the Cartesian receptor grid. A base elevation of 240 ft (73 m) was estimated from the topographical maps.

For the tower, the emission rate was divided into an amount for each hour of the day. It was assumed that the materials will be burned three times per day, for one hour at 0900, 1200, and 1500 hours CST. These hours of the day were chosen because they occur during workday hours and represent a training scenario under atmospheric conditions in the morning, at noon, and in the afternoon. In order to be conservative, this method for characterizing the release was chosen, even though it assumes that the events occur on weekends as well.

It was assumed that the materials are being burned inside an enclosed structure and that the emissions escape through windows in the structure. Therefore, the plume was modeled as a volume type with dimensions dependent on the dimensions of the structure. The volume source properties were computed following the recommendations for an elevated volume source in the USEPA (1995c, Table 1-6). It was assumed that the building constructed will be 6.7 m long, 14.8 m wide, and 12.2 m tall. These dimensions come from a schematic, located on the Internet, of another drill tower used for firefighter training (High Country Training Center 2000). The plume's initial horizontal dispersion coefficient was then computed by averaging the tower width and length and dividing by 4.3 (specified in USEPA 1995c, Table 1-6). The plume's initial vertical dispersion coefficient was set equal to the height of the tower divided by 2.15 (specified in USEPA 1995c, Table 1-6). The effective height of emission was set equal to the tower's height, 12.2 m. It was also assumed that the tower's wake affects dispersion of the plume and causes the plume rise to be negligible.

3.6.3 Receptor Pathway

The receptor grid was defined as a variable Cartesian grid of 100 m spacing for the first km, 500 m between 1 km and 3 km, and 1 km between 3 km and 8 km as illustrated in Figure 13. This same grid was used for both the nonwatershed and watershed areas. The receptor points were defined as ordered triples, as shown in Figure 14. The DISCART parameters identify the discrete Cartesian grid points as easterly UTM coordinate, northerly

UTM coordinate, and elevation in meters. A total of 751 receptors were used.

A common receptor grid was used for all three scenarios evaluated in this risk assessment. The approximate center of the three scenarios was located and used as the center of the Cartesian receptor grid. The UTM location of the centroid was 538500 easterly by 36080000 northerly.

"Selected" Creek was selected as the waterbody having the most potential to be impacted by emissions from the facility. This creek was selected because of its close proximity to the facility and because it lies in the path of the predominate downwind direction. Since the overall watershed for the creek is too extensive to effectively model, an area nearest the facility was selected as the representative watershed (Figure 6). The representative watershed includes that area in the path of maximum dry and wet deposition. The use of this representative watershed as opposed to the actual watershed typically result in more conservative predictions of watershed air modeling values.

3.6.4 Meteorological Pathway

For the ISCST3 model, the meteorological pathway was used only to identify the name of the meteorological input file, anemometer height, and the station number and beginning year of the meteorological data. Refer to Section 3.4 for a detailed discussion of the meteorological data.

3.6.5 Output Pathway

The output pathway was used to set up output tables of maximum values and plot files which contain a value for each receptor node. The output from the ISCST3 model included the unitized yearly air concentrations for the vapor and particle phases for each

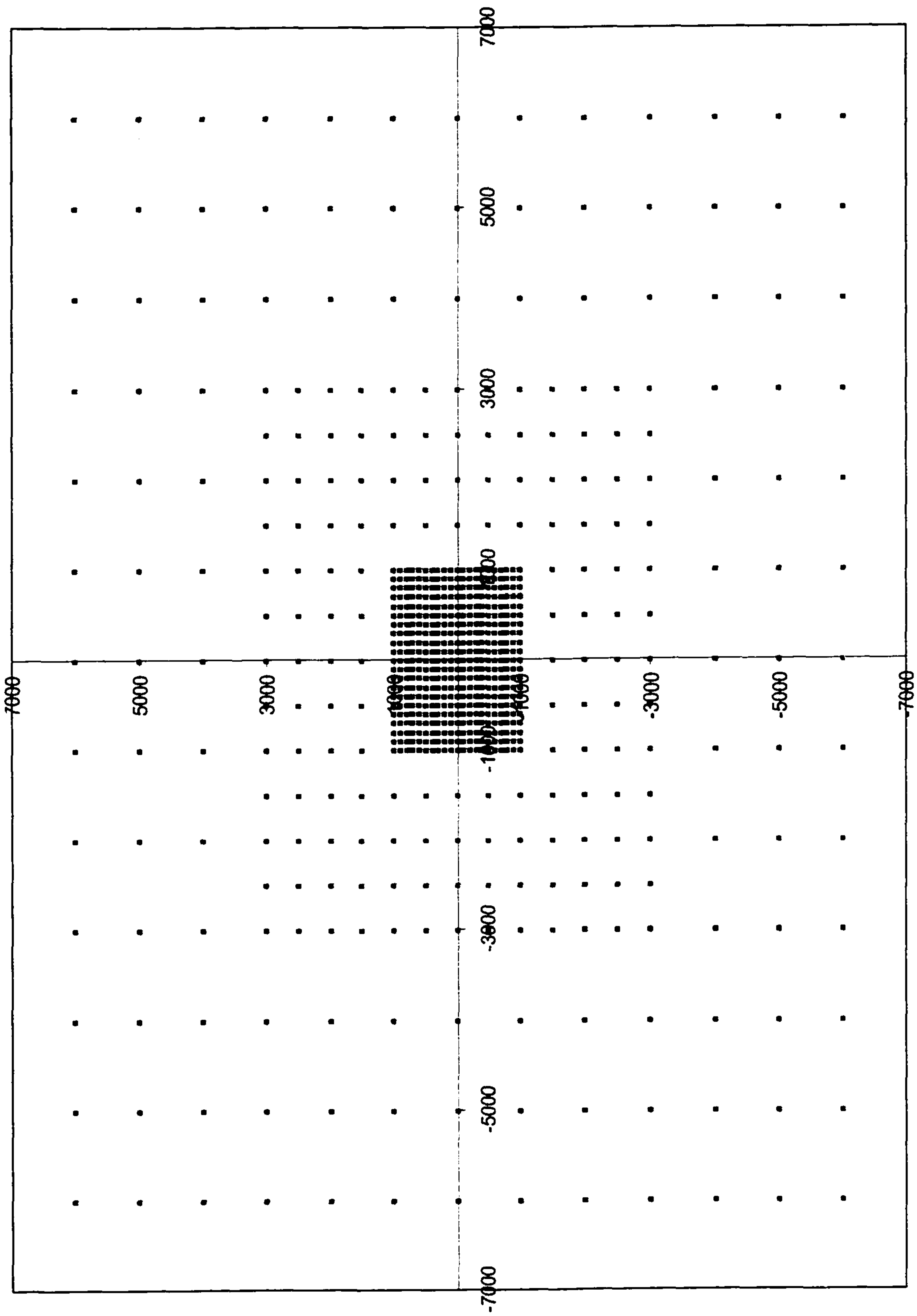


Figure 13 Receptor Grid

```
RE STARTING
RE ELEVUNIT METERS
** X (m) Y (m) Elevation(m)
RE DISCCART 426250 3065080 141.732
RE DISCCART 426250 3066080 141.732
RE DISCCART 426250 3067080 155.448
RE DISCCART 426250 3068080 163.068
RE DISCCART 426250 3069080 167.64
RE DISCCART 426250 3070080 172.212
        .
        . (There are 751 receptors)
        .
RE DISCCART 442250 3068080 162.4584
RE DISCCART 442250 3069080 167.0304
RE DISCCART 442250 3070080 168.2496
RE DISCCART 442250 3071080 179.5272
RE FINISHED
```

Figure 14. Receptor Pathway

receptor in $\mu g \cdot s/g \cdot m^3$, or the unitized yearly deposition rates for dry deposition and wet deposition in units of $g/m^2 \cdot yr/g/s$. The ISCST3 model produced results in tabular summaries by receptor in a plotter file. The plotter output file, which lists the X and Y coordinates along with the air modeling values, was sorted in order of concentration and deposition values and used to determine the maximum off-site concentration and deposition. The plotter files created for each of the watershed runs were summed and an overall average concentration or deposition value determined.

3.6.6 Terrain Pathway

The elevation of the area around the facility was entered through the receptor pathway. A terrain pathway was not needed.

3.7 Summary of Air Modeling Results

For the HHRA, direct inhalation exposure was evaluated at the location of the maximum off-site vapor air concentration since it was assumed that no person, potentially residing in the area, would have access within the facility boundaries. For indirect exposure, wet and dry deposition values are needed in addition to the vapor air concentration. For the HHRA, the maximum off-site deposition values were used. As is the case in most assessments, the maximum off-site air concentrations and maximum off-site deposition values were not located at the same Cartesian grid receptor node. However, in order to provide the most conservative estimates, the air concentration and deposition values were assumed to be co-located. Use of the deposition values reported at the maximum off-site air concentration receptor node or use of the air concentration at the maximum off-site deposition receptor node would result in smaller estimates of risk. In accordance with the USEPA (1998a) guidance, the areal average air concentration and areal average combined deposition from all receptors for the watershed model run were used rather than the highest values from the set of individual receptors that lie within the watershed boundary.

Tables 16, 17, and 18 display maximum off-site air modeling results for the ARFF, propane system, and drill tower scenarios, respectively. Watershed values are listed for “Selected” Creek. A description of the watershed location is provided in Section 3.6.3. The values for the maximum off-site receptor node and the watershed values for “Selected” Creek were used as air modeling input into fate and transport equations for the determination of a reasonable estimate of risk. Contour plots for the vapor phase, dry deposition phase, and wet deposition phase are included in Figures 15 through 23.

Table 16. Air Modeling Results for ARFF Scenario; Maximum Offsite Location

Parameter	Description	Location X	Location Y	Value
Vapor Phase Values				
Cyv	Unitized yearly average air concentration (μg·s/g·m^3)	-100	300	0.091
Dywv	Unitized yearly average wet deposition (s/m^2·yr)	0	-300	0.010
Particle Phase Values				
Cyp	Unitized yearly average air concentration (μg·s/g·m^3)	-100	300	0.091
Dydp	Unitized yearly average dry deposition (s/m^2·yr)	-100	300	0.001
Dywp	Unitized yearly average wet deposition (s/m^2·yr)	0	-300	0.006
Particle-Bound Phase Values				
Cyp	Unitized yearly average air concentration (μg·s/g·m^3)	-100	300	0.091
Dywdp	Unitized yearly average dry deposition (s/m^2·yr)	-100	300	0.001
Dywp	Unitized yearly average wet deposition (s/m^2·yr)	0	-300	0.007
Acute Values				
Chv	Unitized hourly air concentration from vapor phase (μg·s/g·m^3)	-400	100	60.1
Chp	Unitized hourly air concentration from particle phase (μg·s/g·m^3)	-400	100	62.3
Chpb	Unitized hourly air concentration from particle-bound phase (μg·s/g·m^3)	-400	100	62.3
Watershed Values ("Selected" Creek)				
Cywv	Unitized yearly watershed average air concentration from vapor phase (μg·s/g·m^3)	Areal Average		0.012
Dywwv	Unitized yearly watershed average wet deposition from vapor phase (s/m^2·yr)	Areal Average		0.001
Dytwp	Unitized yearly watershed average total (wet and dry) deposition from particle phase (s/m^2·yr)	Areal Average		0.001
Dytwp	Unitized yearly watershed average total (wet and dry) deposition from particle-bound phase (s/m^2·yr)	Areal Average		0.001

Table 17. Air Modeling Results for Propane System Scenario; Maximum Offsite Location

Parameter	Description	Location X	Location Y	Value
Vapor Phase Values				
Cyv	Unitized yearly average air concentration (μg·s/g·m^3)	100	300	3.314
Dywv	Unitized yearly average wet deposition (s/m^2·yr)	0	300	0.046
Particle Phase Values				
Cyp	Unitized yearly average air concentration (μg·s/g·m^3)	100	300	3.306
Dydp	Unitized yearly average dry deposition (s/m^2·yr)	100	300	0.032
Dywp	Unitized yearly average wet deposition (s/m^2·yr)	0	300	0.025
Particle-Bound Phase Values				
Cyp	Unitized yearly average air concentration (μg·s/g·m^3)	100	300	3.306
Dywdp	Unitized yearly average dry deposition (s/m^2·yr)	100	300	0.038
Dywp	Unitized yearly average wet deposition (s/m^2·yr)	0	300	0.033
Acute Values				
Chv	Unitized hourly air concentration from vapor phase (μg·s/g·m^3)	400	100	696.3
Chp	Unitized hourly air concentration from particle phase (μg·s/g·m^3)	400	100	691.3
Chpb	Unitized hourly air concentration from particle-bound phase (μg·s/g·m^3)	400	100	691.1
Watershed Values ("Selected" Creek)				
Cywv	Unitized yearly watershed average air concentration from vapor phase (μg·s/g·m^3)	Areal Average		0.755
Dywwv	Unitized yearly watershed average wet deposition from vapor phase (s/m^2·yr)	Areal Average		0.016
Dytwp	Unitized yearly watershed average total (wet and dry) deposition from particle phase (s/m^2·yr)	Areal Average		0.015
Dytwp	Unitized yearly watershed average total (wet and dry) deposition from particle-bound phase (s/m^2·yr)	Areal Average		0.019

Table 18. Air Modeling Results for Drill Tower Scenario; Maximum Offsite Location

Parameter	Description	Location X	Location Y	Value
Vapor Phase Values				
Cyv	Unitized yearly average air concentration (μg·s/g·m^3)	0	300	1.119
Dywv	Unitized yearly average wet deposition (s/m^2·yr)	-100	300	0.030
Particle Phase Values				
Cyp	Unitized yearly average air concentration (μg·s/g·m^3)	0	300	0.838
Dydp	Unitized yearly average dry deposition (s/m^2·yr)	0	300	0.858
Dywp	Unitized yearly average wet deposition (s/m^2·yr)	-100	300	0.028
Particle-Bound Phase Values				
Cyp	Unitized yearly average air concentration (μg·s/g·m^3)	0	300	1.069
Dywdp	Unitized yearly average dry deposition (s/m^2·yr)	0	300	0.160
Dywp	Unitized yearly average wet deposition (s/m^2·yr)	-100	300	0.015
Acute Values				
Chv	Unitized hourly air concentration from vapor phase (μg·s/g·m^3)	0	300	431.4
Chp	Unitized hourly air concentration from particle phase (μg·s/g·m^3)	0	300	407.0
Chpb	Unitized hourly air concentration from particle-bound phase (μg·s/g·m^3)	-100	400	432.4
Watershed Values ("Selected" Creek)				
Cywv	Unitized yearly watershed average air concentration from vapor phase (μg·s/g·m^3)	Areal Average		0.070
Dywwv	Unitized yearly watershed average wet deposition from vapor phase (s/m^2·yr)	Areal Average		0.002
Dytwp	Unitized yearly watershed average total (wet and dry) deposition from particle phase (s/m^2·yr)	Areal Average		0.031
Dytwp	Unitized yearly watershed average total (wet and dry) deposition from particle-bound phase (s/m^2·yr)	Areal Average		0.007

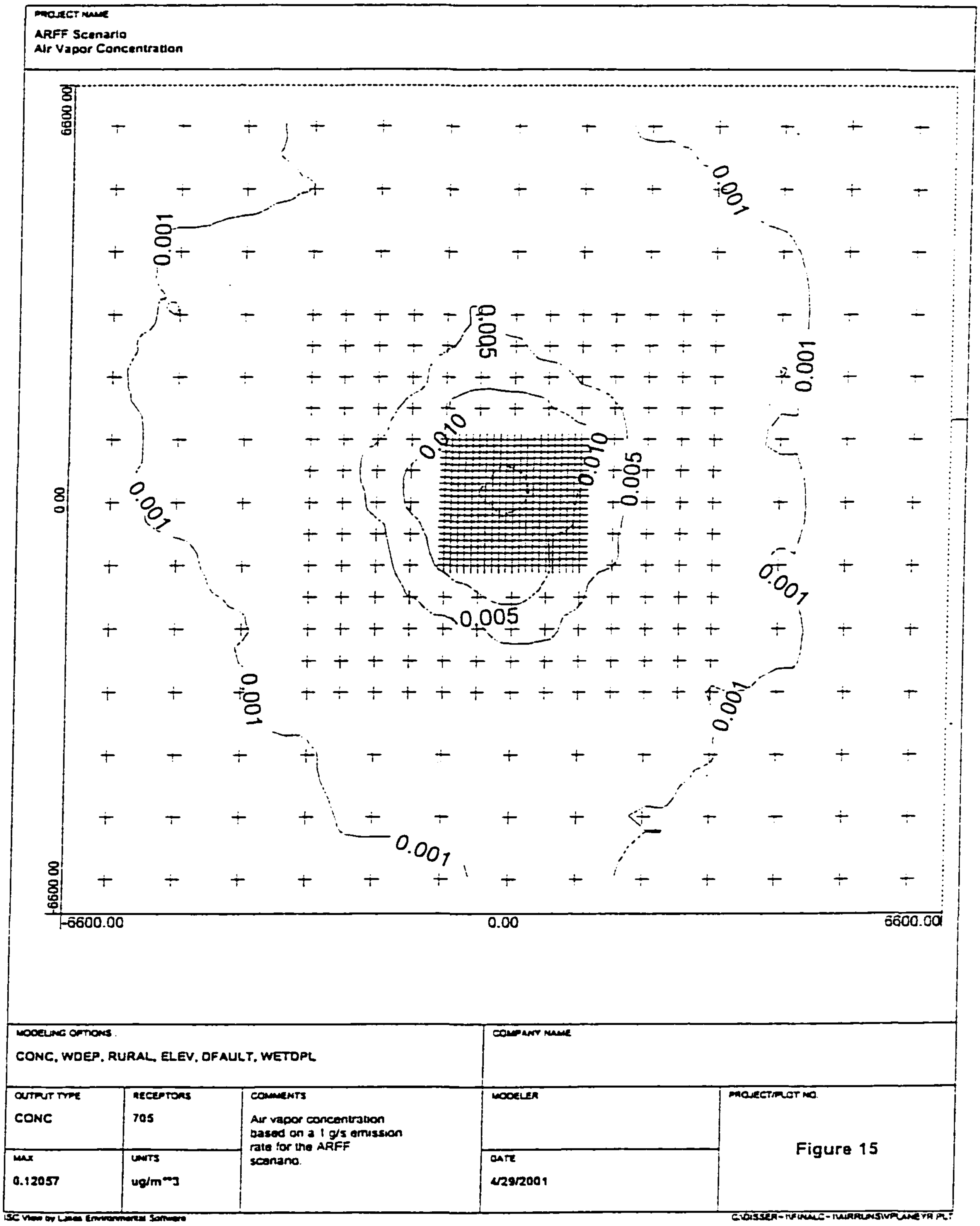


Figure 15. ARRF - Air Vapor Concentration

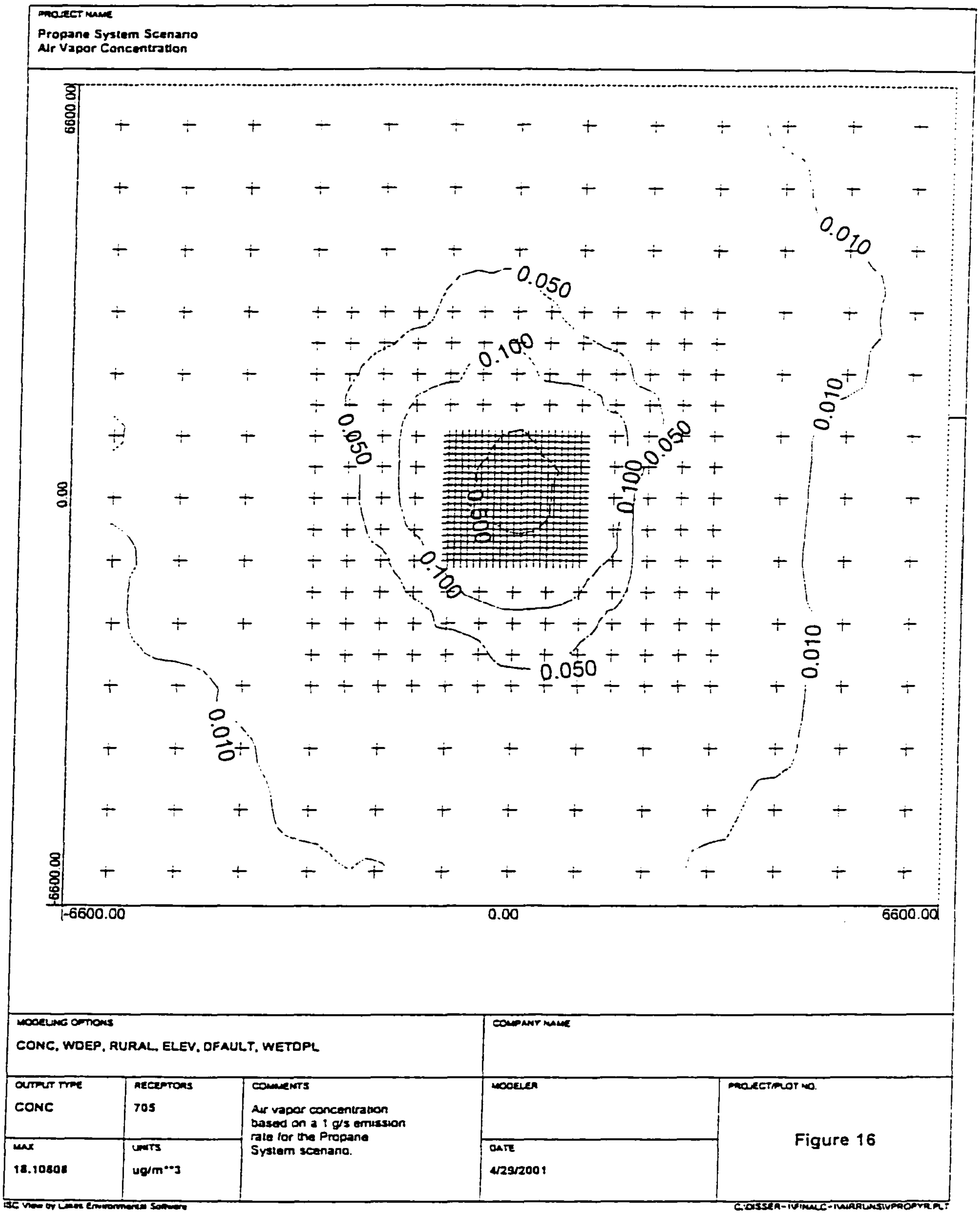


Figure 16. Propane System - Air Vapor Concentration

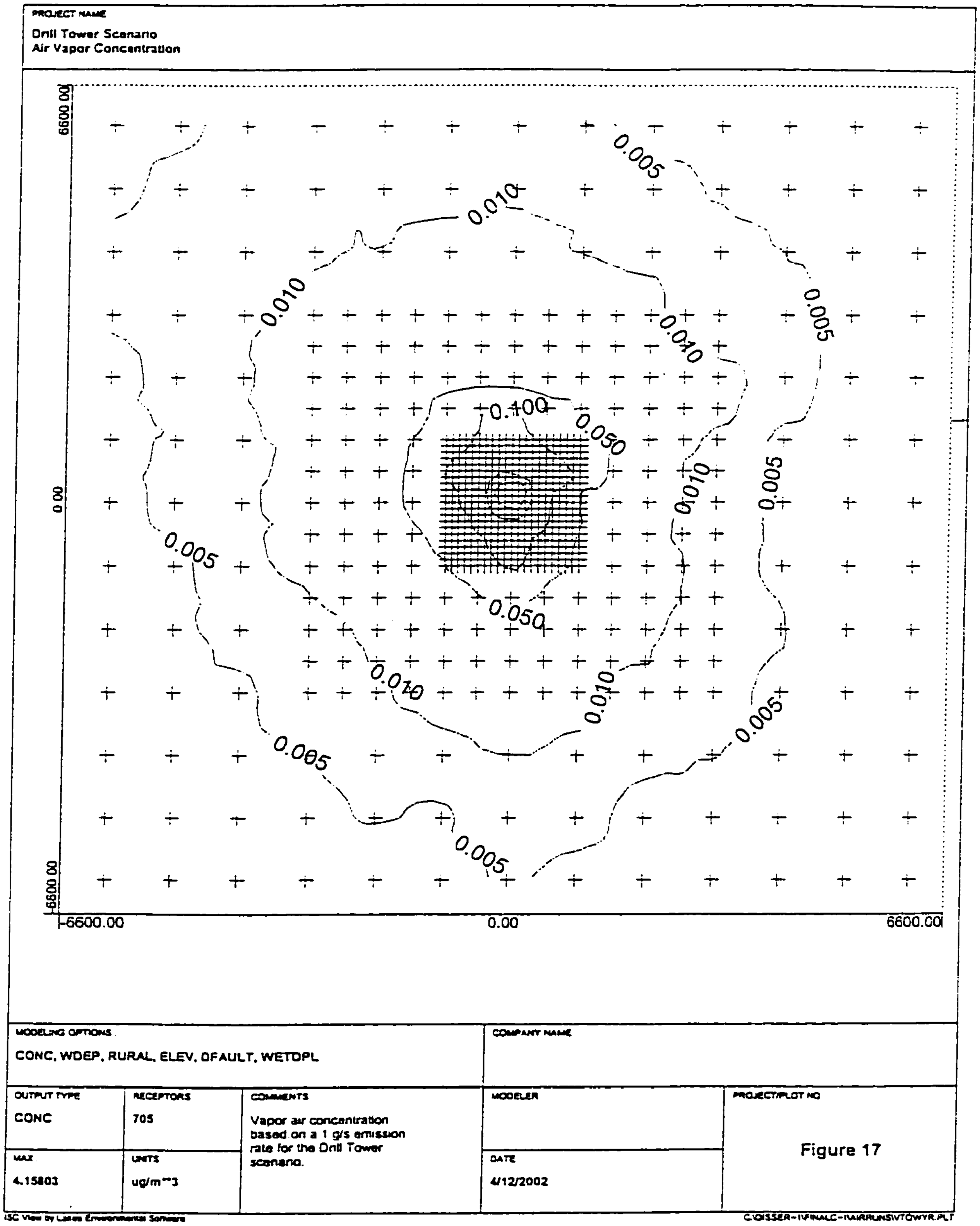


Figure 17. Drill Tower - Air Vapor Concentration

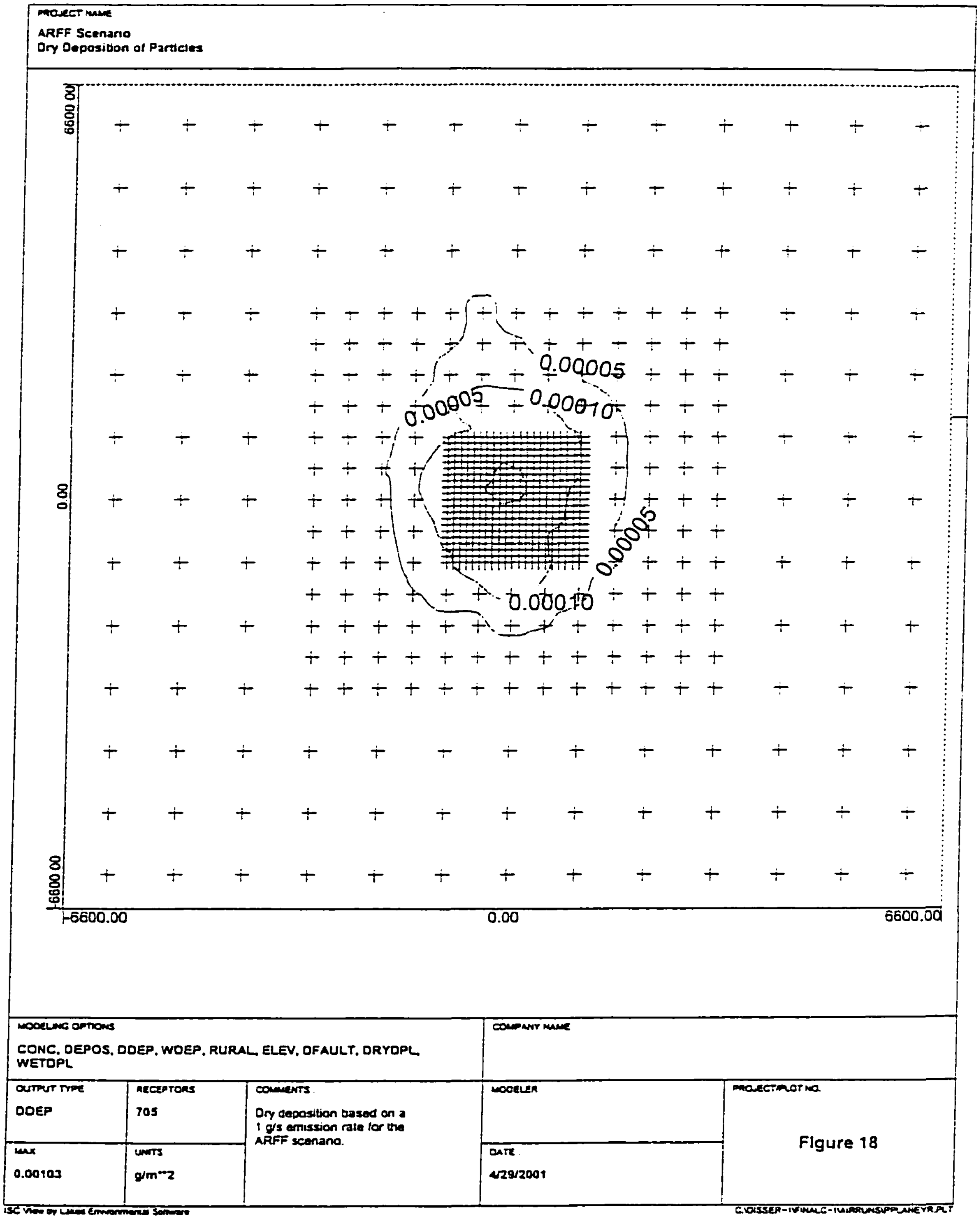


Figure 18. ARRF - Dry Deposition of Particles

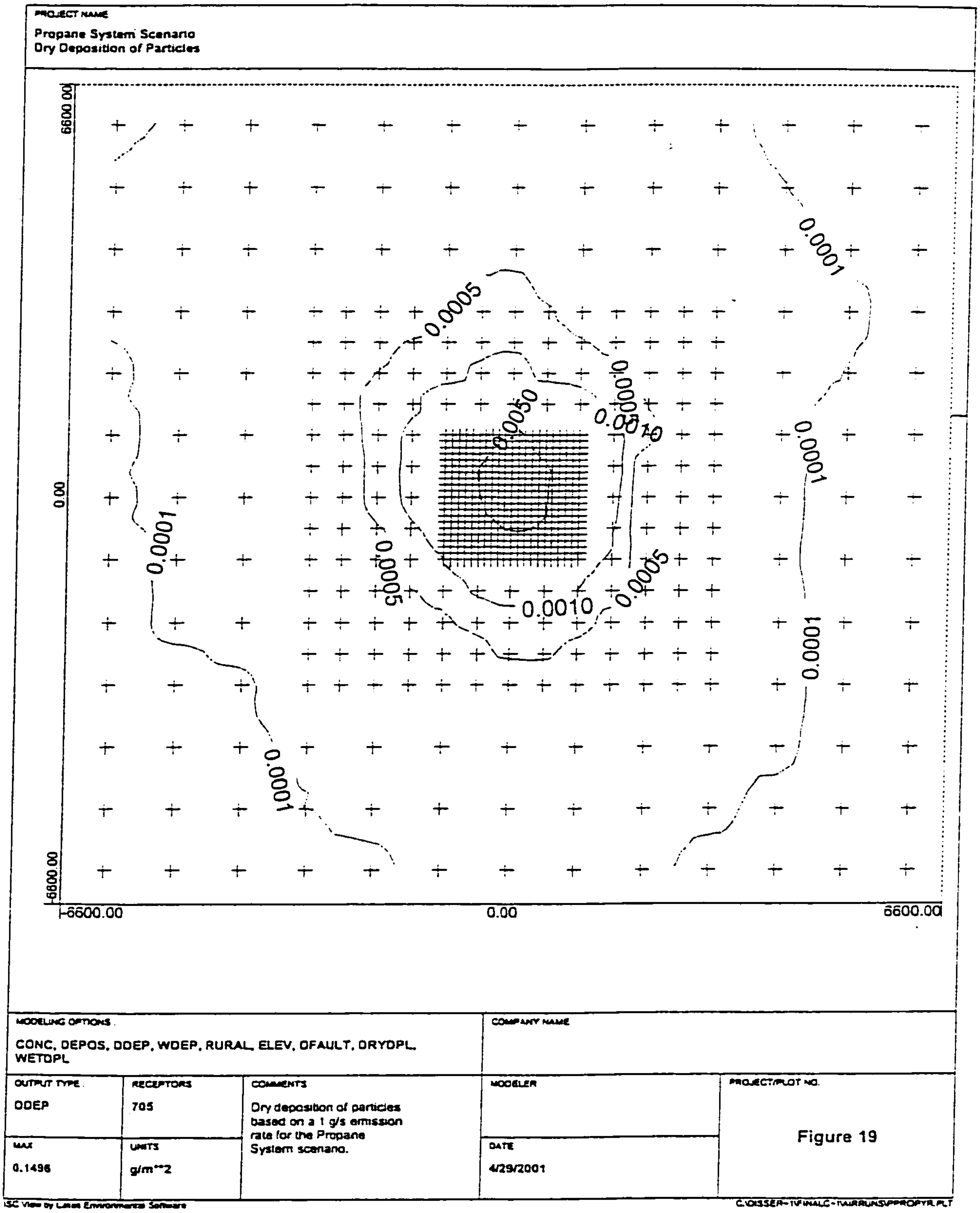


Figure 19. Propane System - Dry Deposition of Particles

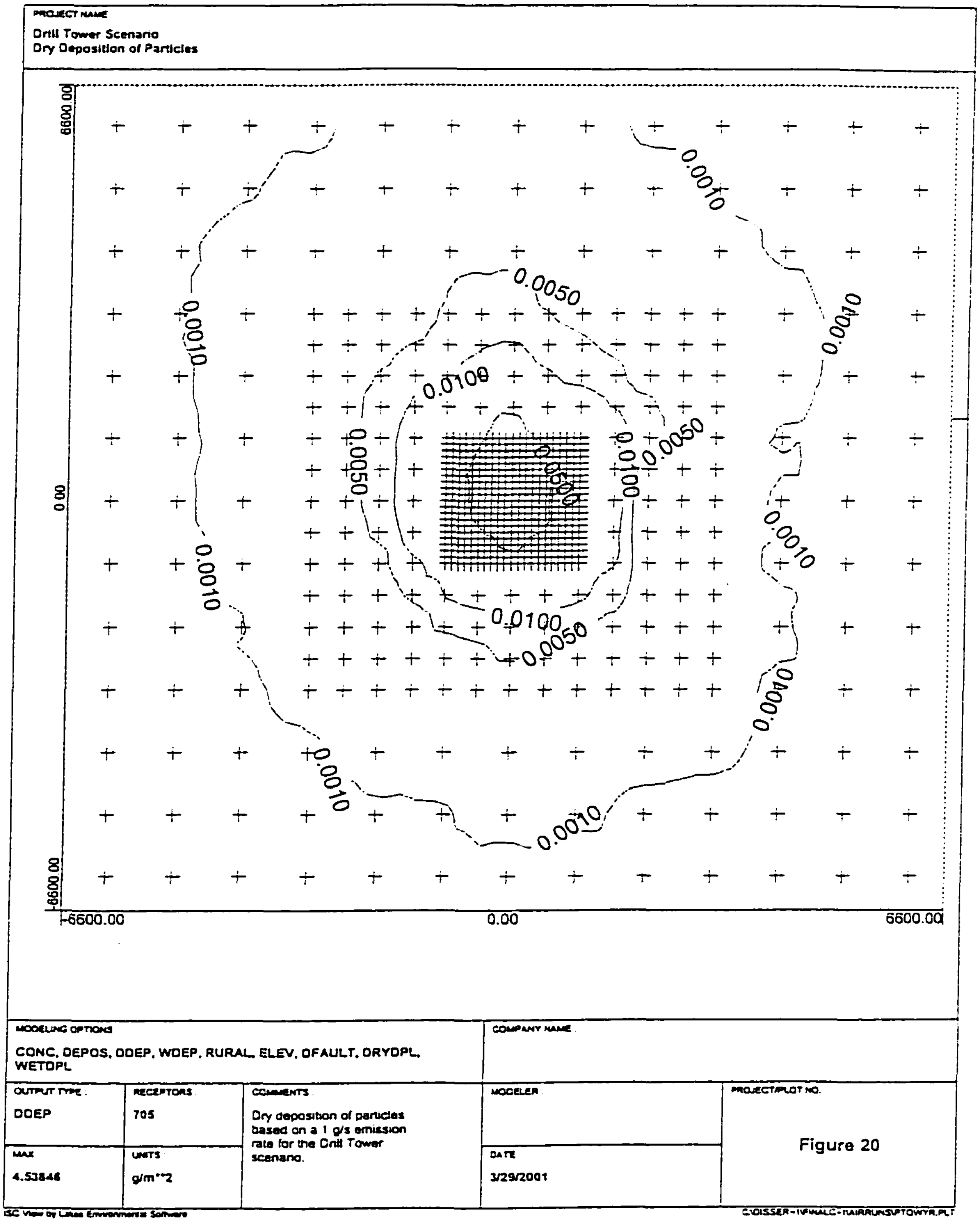


Figure 20. Drill Tower - Dry Deposition of Particles

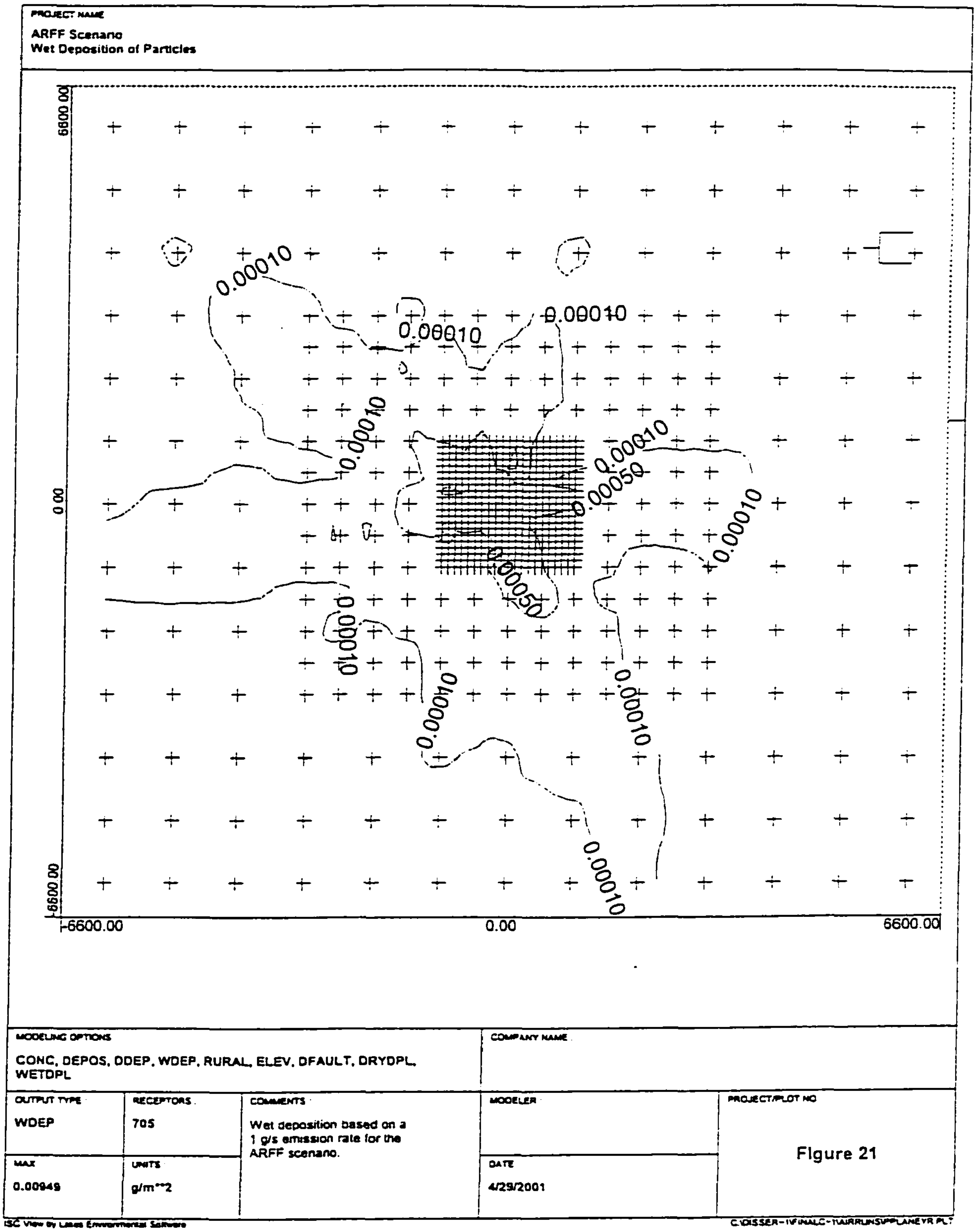


Figure 21. ARRF - Wet Deposition of Particles

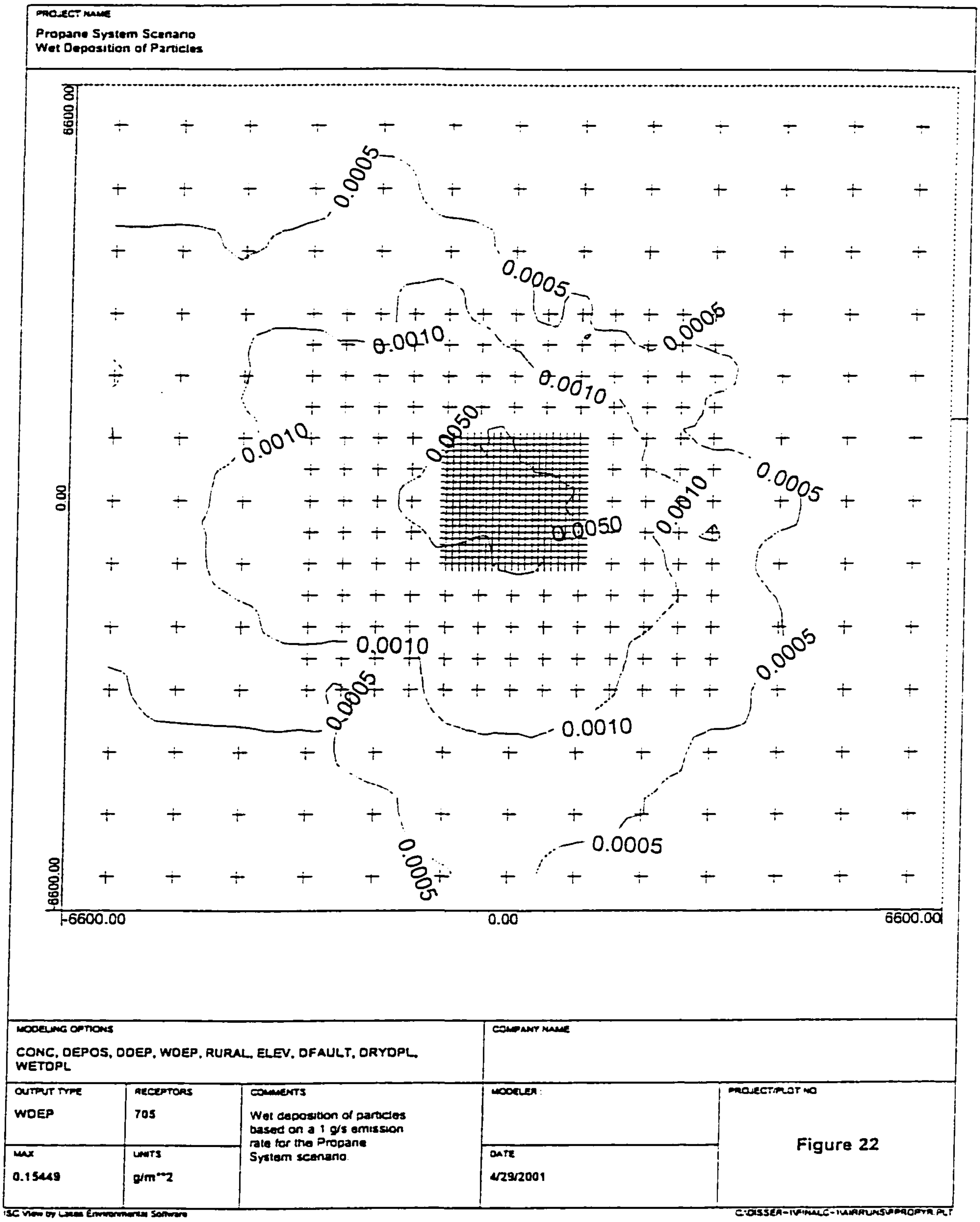


Figure 22. Propane System - Wet Deposition of Particles

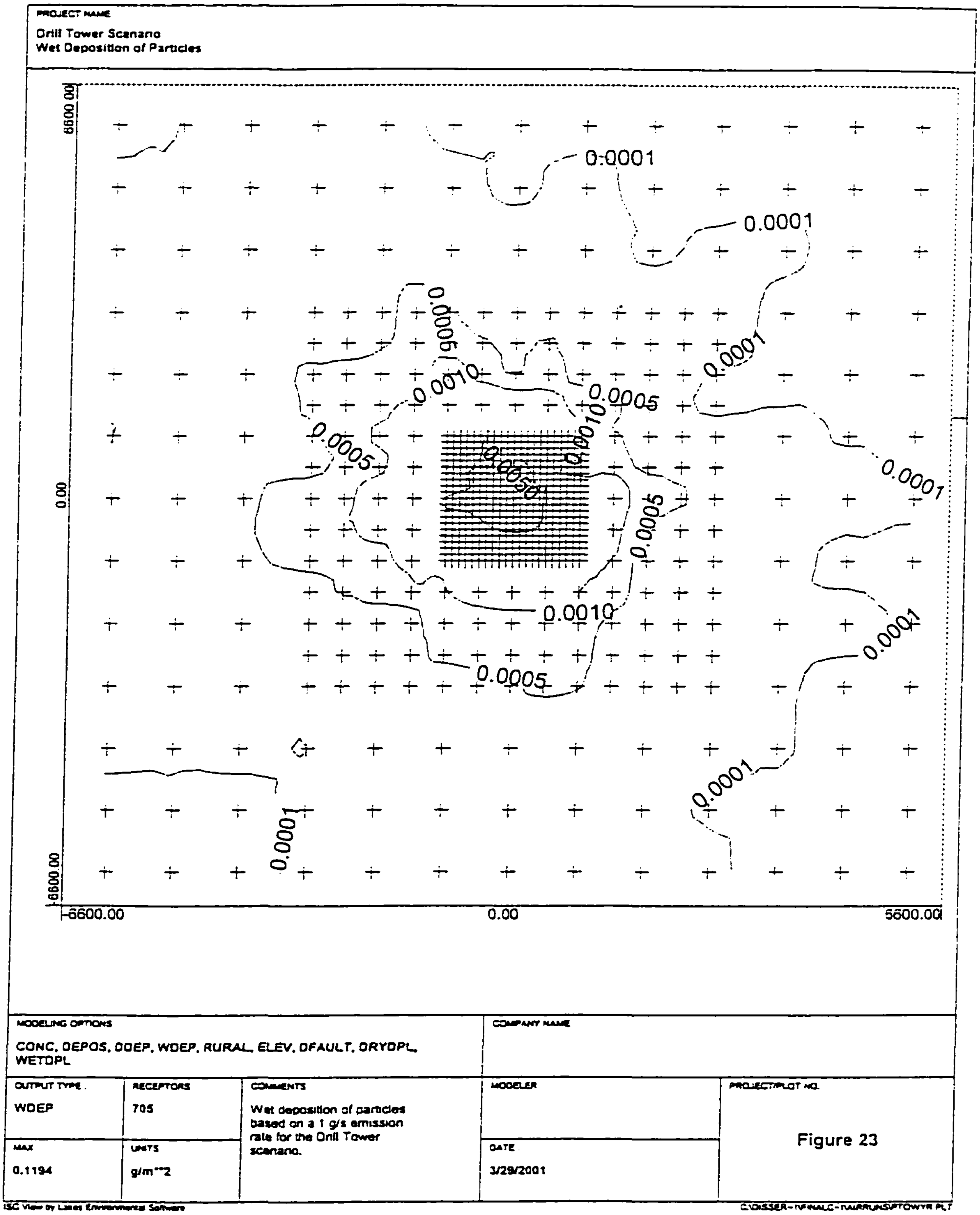


Figure 23. Drill Tower - Wet Deposition of Particles

4.0 HUMAN HEALTH RISK ASSESSMENT

HHRA is defined as the scientific evaluation of potential health impacts that may result from exposure to a particular substance or mixture of substances under specified conditions. The purpose of this risk assessment is to provide a quantitative analysis, in a conservative and health-protective manner, of the likelihood that adverse effects might be associated with potential exposures to chemicals in environmental media as a result of emissions produced during firefighter training scenarios at the Facility.

According to risk assessment guidelines (USEPA 1989, NAS 1983), risk assessment generally consists of four basic steps that can be summarized as follows:

- Hazard Assessment. An evaluation of sampling data, determination of the nature and amount of chemicals that could be potentially encountered in environmental media, and selection of those COCs for the assessment of the impact on human health.

- Exposure Assessment. Quantification of the extent, frequency, and duration of actual or potential exposure to chemicals by relevant pathways to identified receptors.

- Dose-Response Toxicity Assessment. Identification of the types of adverse health effects that could be associated with exposure (dose) and the probability of occurrence of the health impact (response), and discussion of the related uncertainties.

- Risk Characterization. Estimation of the probability that an adverse health impact may occur as a result of exposure to chemicals in the amount and by the pathways identified, and the uncertainty in those estimates.

The intent of this HHRA is to provide estimates of risk, under direct and indirect exposure scenarios, to the identified receptors -- i.e., potential receptors assumed to be exposed to multiple chemicals by multiple pathways (USEPA 1998a). To estimate the risk for direct and indirect exposure data on the potential chemical emissions were reviewed; the chemicals, pathways, and receptors that are most relevant to estimates of risk were selected; estimates of intake by chemical, pathway and receptor were made using relevant algorithms; and estimates of risk were developed. A discussion of the relevance of such estimates and the uncertainties associated with the estimated risks is an integral part of the risk assessment. Variables (i.e., a chemical, pathway, or parameter value) contributing most to estimates of risk or to the uncertainty in the risk assessment were identified. Each of these steps is discussed in more detail in the following sections.

4.1 Toxicity Assessment

The Toxicity Assessment step combines the Hazard Assessment and Dose-Response steps of the Risk Assessment process. This section describes the anticipated emissions and the approach to the selection of the chemicals to be used in the quantitative risk assessment. The chemicals selected for inclusion in this risk analysis were those for which a toxicity value had been assigned by the USEPA, and had some possibility of being released and transported by way of a particular pathway.

4.1.1 Hazard Assessment

This step in the risk assessment process includes the identification of the chemicals that may be emitted during training scenarios conducted at the Facility. Section 2.0

provides a detailed discussion of the selection of COCs to be used in this assessment and estimation of emission rates for these COCs.

4.1.2 Toxicity/Dose-Response Assessment

The next phase of analysis was to conduct a review of potential human health effects, both carcinogenic and noncarcinogenic, associated with the selected chemicals described in Section 2. The toxicological criteria used to evaluate potential health effects were cancer slope factors (CSFs) [units of $(mg/kg/day)^{-1}$] used to characterize upper bound risks for potential carcinogens and oral reference doses (RfDs) [mg/kg/day] used to characterize potential noncancer health effects. With regard to inhalation (direct) exposures, the toxicological criteria were unit risk factors (URFs) [$(\mu g/m^3)^{-1}$] for carcinogens and reference concentrations (RfCs) [mg/m^3] for noncarcinogens. For those chemicals not listed in Appendix A-3 of the USEPA Guidance (USEPA 1998a), criterion values were obtained from USEPA's Integrated Risk Information System (IRIS) (USEPA 1999a) and Health Effects Assessment Summary Tables (HEAST) (USEPA 1995g).

A CSF for a chemical is defined as the upper bound estimate of the number of extra cancers that may occur per one million persons exposed for an entire lifetime (assumed to be 70 years) per mg of chemical exposure per kilogram of body weight per day (mg/kg/day) or per microgram/cubic meter of air ($\mu g/m^3$) in the use of a URF. Each CSF is derived from the quantitative evaluation of data from either epidemiological studies (studies of human health) or, in the absence of epidemiological data, from chronic (lifetime) bioassays in rodents. To derive a CSF, all of the cancer incidence data are evaluated, and the endpoint (i.e., tumor type) that results in the largest CSF is used to define the cancer potency for that chemical. Health protective assumptions are used when developing the CSF; that is, it is assumed that there is no threshold; observations seen at high exposure concentrations, such as in the animal bioassays or in occupational settings, are considered predictive of the dose-response for very low exposure levels that may result from exposure to the chemical in the environment. It is also assumed, when using animal studies, that humans are more sensitive to the chemical agents than animals, and the final CSF is adjusted upward. As stated in the USEPA Risk Assessment guidelines (USEPA 1986), the CSF is an upper bound estimate and that the true value for the cancer potency may be lower and may be as low as zero.

An RfD is based on the assumption that a threshold exists for noncancer effects. The RfD is an estimate of the amount of a chemical to which an individual (including sensitive subpopulations) may be exposed through various routes of exposure every day for a lifetime without experiencing an adverse health effect. The RfD is based on either epidemiological or animal bioassays. When based on animals data, all the noncancer data for a chemical are reviewed and the endpoint (e.g., increased liver weight) that occurs at the lowest dose; that is, the most sensitive endpoint in the most sensitive species is selected as the basis for the derivation of the RfD. Once the endpoint is selected, then the next lowest dose, the No Observed Adverse Effect Level (NOAEL), is identified and divided by uncertainty factors (UCFs) (typically a factor of 100 up to a factor of 3,000). Consequently, the RfD is the daily dose that is 100 to 3000 times lower than the NOAEL, i.e., the dose that did not result in the most sensitive endpoint of concern in the animal bioassay. The UCF is included to ensure that the RfD is protective of the most sensitive populations and accounts for inadequacies or uncertainties in the data. Because the RfD is based on the most sensitive endpoint in the most sensitive species, it is protective against other types of toxicity that may have been noted in the animal studies but occurred only at doses higher than that which produced the toxicity used as the basis for the derivation of the RfD. For example, the RfD for toluene is based on a change in liver and kidney weights in rats (USEPA 1999a). The dose at which this effect was noted (i.e., the Lowest Observed Adverse Effect Level - LOAEL) was 446 mg/kg/day and the NOAEL was 223 mg/kg/day. An UCF of 1000 was applied to the NOAEL to achieve the RfD of 0.2 mg/kg/day. Other toxicity, such as signs of neurotoxicity, was seen only at doses greater than 1700 mg/kg/day or 8 times higher than the NOAEL and 8500 times higher than the RfD. Consequently, if the estimated daily intake for toluene is lower than the RfD, no adverse effects, including neurotoxic effects, would be expected. The RfD is considered a benchmark dose, that is, exposures below the RfD are unlikely to be associated with a health risk, but as exposures exceed this level, the probability of an adverse effect increases. A corresponding approach is taken for the derivation of an RfC.

All of the toxicity criteria values used are listed in Table 19. If a toxicity value could not be assigned, the chemical was not included in the quantitative analyses, as per USEPA Guidelines (USEPA 1998a). Chemicals removed from the evaluation of the ARFF scenario due to lack of toxicity values were nitrobenzofluoranthene, nitrochrysene/benzanthracene, phenanthrene, cobalt, and fluorine. Only cobalt was removed from evaluation of the propane system scenario due to lack of toxicity values. For the drill tower scenario for the combustion of wood, benzo[e]pyrene, methane, ethane, ethylene, acetylene, propane, propene, i-butane, n-butane, butene, pentene, 2-methyl furan, 2,5 dimethyl furan, aluminum, calcium, cobalt, iron, magnesium, phosphorus, potassium,

Table 19 Toxicity Criteria

Chemical	Cas Number	TEF (unitless)	RfD (mg/kg/day)	Oral CSF $(mg/kg/day)^{-1}$	RfC (mg/m^3)	Inhalation URF $(\mu g/m^3)$	Inhalation CSF $(mg/kg/day)^{-1}$
1,2,3,4,6,7,8,9-OCDD	3268-87-9	0.001	ND	1.50E+05	ND	3.30E+01	1.50E+05
1,2,3,4,6,7,8,9-OCDF	39001-02-0	0.001	ND	1.50E+05	ND	3.30E+01	1.50E+05
1,2,3,4,6,7,8-HPCDD	35822-46-9	0.01	ND	1.50E+05	ND	3.30E+01	1.50E+05
1,2,3,4,6,7,8-HPCDF	67562-39-4	0.01	ND	1.50E+05	ND	3.30E+01	1.50E+05
1,2,3,4,7,8-HXCDD	39227-28-6	0.1	ND	1.50E+05	ND	3.30E+01	1.50E+05
1,2,3,4,7,8-HXCDF	70648-26-9	0.1	ND	1.50E+05	ND	3.30E+01	1.50E+05
1,2,3,6,7,8-HXCDD	57653-85-7	0.1	ND	1.50E+05	ND	3.30E+01	1.50E+05
1,2,3,6,7,8-HxCDF	57117-44-9	0.1	ND	1.50E+05	ND	3.30E+01	1.50E+05
1,2,3,7,8,9-HXCDD	19408-74-3	0.1	ND	1.50E+05	ND	3.30E+01	1.50E+05
1,2,3,7,8-PECDD	40321-76-4	0.5	ND	1.50E+05	ND	3.30E+01	1.50E+05
1,2,3,7,8-PECDF	57117-41-6	0.05	ND	1.50E+05	ND	3.30E+01	1.50E+05
2,3,4,6,7,8-HXCDF	60851-34-5	0.1	ND	1.50E+05	ND	3.30E+01	1.50E+05
2,3,4,7,8-PECDF	57117-31-4	0.5	ND	1.50E+05	ND	3.30E+01	1.50E+05
2,3,7,8-TCDF	51207-31-9	0.1	ND	1.50E+05	ND	3.30E+01	1.50E+05
2-Methylnaphthalene	91-57-6	1	4.00E-02	ND	ND	ND	ND
Acenaphthene	83-32-9	1	6.00E-02	ND	2.10E-01	ND	ND
Acenaphthylene	208-96-8	1	6.00E-02	ND	ND	ND	ND
Acetaldehyde	75-07-0	1	2.60E-03	7.70E-03	9.00E-03	2.20E-06	7.70E-03
Anthracene	120-12-7	1	3.00E-01	ND	1.10E+00	ND	ND
Antimony	7440-36-0	1	4.00E-04	ND	1.43E-03	ND	ND

Table 19 (continued)

Chemical	Cas Number	TEF (unitless)	RfD (mg/kg/day)	Oral CSF $(mg/kg/day)^{-1}$	RfC (mg/m^3)	Inhalation URF $(\mu g/m^3)$	Inhalation CSF $(mg/kg/day)^{-1}$
Arsenic	7440-38-2	1	3.00E-04	1.5	1.10E-03	4.30E-03	1.50E+01
Barium	7440-39-3	1	7.00E-02	ND	5.00E-04	ND	ND
Benzaldehyde	100-52-7	1	1.01E-01	ND	3.50E-01	ND	ND
Benzene	71-43-2	1	1.70E-02	2.90E-02	6.00E-02	8.30E-06	2.90E-02
Benzo(a)pyrene	50-32-8	1	ND	7.30E+00	ND	2.10E-03	7.30E+00
Benzo(g,h,i)perylene	191-24-2	1	3.00E-02	ND	ND	ND	ND
Benzo[a]anthracene	56-55-3	1	ND	7.31E-01	ND	2.10E-04	7.31E-01
Benzo[b]fluoranthene	205-99-2	1	ND	7.30E-01	ND	2.10E-04	7.30E-01
Benzo[k]fluoranthene	207-08-9	1	ND	7.30E-02	ND	2.10E-05	7.30E-02
Beryllium	7440-41-7	1	2.00E-03	8.40E+00	2.00E-02	2.40E-03	8.40E+00
Cadmium	7440-43-9	1	1.03E-03	ND	2.00E-04	1.80E-03	6.3
Chlorine	7782-50-5	1	1.00E-01	ND	2.00E-04	ND	ND
Chromium	7440-47-3	1	1.50E+00	ND	5.25E+00	ND	ND
Chromium VI	18540-29-9	1	3.00E-03	ND	1.40E-04	1.20E-02	42
Chrysene	218-01-9	1	ND	7.30E-03	ND	2.10E-06	ND
Dibenz[a,h]anthracene	53-70-3	1	ND	7.3	ND	2.10E-03	7.3
Ethylbenzene	100-41-4	1	1.00E-01	ND	1	ND	ND
Fluoranthene	206-44-0	1	4.00E-02	ND	1.40E-01	ND	ND
Fluorene	86-73-7	1	4.00E-02	ND	1.40E-01	ND	ND
Formaldehyde	50-00-0	1	2.00E-01	4.50E-02	7.00E-01	1.30E-05	4.50E-02
Furans	110-00-9	1	1.00E-03	ND	ND	ND	ND
Indeno[1,2,3-cd]pyrene	193-39-3	1	ND	7.30E-01	ND	2.10E-04	7.30E-01
Lead	7439-92-1	1	ND	ND	ND	ND	ND
Manganese	0	1	1.40E-01	ND	5.00E-05	ND	ND

Table 19 (continued)

Chemical	Cas Number	TEF (unitless)	RfD (mg/kg/day)	Oral CSF $(mg/kg/day)^{-1}$	RfC (mg/m^3)	Inhalation URF $(\mu g/m^3)$	Inhalation CSF $(mg/kg/day)^{-1}$
Methyl Chloroform	71-55-6	1	3.50E-02	ND	1.23E-01	ND	ND
Methylene Chloride	75-09-2	1	6.00E-02	7.50E-03	3.00E+00	4.70E-07	1.60E-03
Naphthalene	91-20-3	1	2.00E-02	ND	3.00E-03	ND	ND
n-Hexane	110-54-3	1	6.00E-02	ND	2.00E-01	ND	ND
Nickel	7440-02-0	1	2.00E-02	ND	7.02E-02	4.80E-04	ND
o-Xylene	95-47-6	1	2.00E+00	ND	7.00E+00	ND	ND
Phenanthrene	85-01-8	1	ND	ND	ND	NA	ND
Phenol	108-95-2	1	6.00E-01	ND	2.10E+00	ND	ND
p-Xylene	106-42-3	1	2.00E+00	ND	7.00E+00	ND	ND
Pyrene	129-00-0	1	3.00E-02	ND	1.10E-01	ND	ND
Selenium	7782-49-2	1	5.00E-03	ND	1.80E-02	ND	ND
Silver	7440-22-4	1	5.00E-03	ND	1.80E-02	ND	ND
Styrene	100-42-5	1	2.00E-01	ND	1.00E+00	ND	ND
Tetrachloroethylene	127-18-4	1	1.00E-02	5.20E-02	4.00E-01	5.80E-07	2.00E-03
Toluene	108-88-3	1	2.00E-01	ND	4.00E-01	ND	ND
Vinyl Acetate	108-05-4	1	1.00E+00	ND	2.00E-01	ND	ND
Zinc	7440-66-6	1	3.00E-01	ND	1.1	ND	ND

ND - No Data Available

a - Toxicity values for PAHs are adjusted by TEFs using the CSF for benzo(a)pyrene.

sodium, and titanium were all removed due to lack of toxicity values. For hay in the drill tower scenario, benzofuran, benzo[e]pyrene, perylene, aluminum, silicon, phosphorus, sulfur, potassium, calcium, titanium, iron, cobalt, gallium, bromine, rubidium, yttrium, zirconium, palladium, indium, lanthanum, gold, and uranium were removed due to lack of toxicity values.

4.1.3 Special Considerations

Certain chemicals within the risk assessment required special consideration or are worthy of specific discussion. These chemicals are identified in the following sections.

4.1.3.1 Dioxins and Furans. Dioxins and furans are contaminants in air emissions of most combustion sources, including forest fires. Their concentration in these emissions is typically minuscule. While the existence of dioxin/furan congeners has not been confirmed through any emission analysis on any training scenario conducted at the Facility, the USEPA Utilities Report (USEPA 1998b) that used as an emission source estimate for the ARFF scenario, provides MEFs for many of the dioxin/furan congeners. According to the USEPA Utilities Report, the list of dioxin/furan congeners was compiled from multiple oil-fired units, and not all congeners were present in the emissions from any one unit. However, as a health protective assumption, all dioxin/furan congeners listed in USEPA (1998b) were included in the risk analysis and potential emissions were calculated for each congener for the ARFF scenario.

The potential risks associated with exposure to 2,3,7,8-PCDD/PCDF congeners were assessed in accordance with the risk assessment approach outlined by USEPA (1994c). Using this Toxicity Equivalent Factor (TEF) approach, the 2,3,7,8-substituted

PCDD/PCDF congeners estimated to be present were characterized by their toxic potency relative to 2,3,7,8-TCDD, the most potent of the PCDD/PCDF congeners. Each congener was modeled through the fate and transport pathways using their congener-specific parameter values. The congener-specific intake was then multiplied by the congener-specific TEF to calculate the TCDD-equivalent intake for each congener. Risk was estimated by multiplying the intake for each congener, expressed as 2,3,7,8-TCDD-equivalents, by the CSF for 2,3,7,8-TCDD congener, which is 1.5×10^5 (mg/kg/day)$^{-1}$ or the URF for 2,3,7,8-TCDD, which is 33 (μg/m^3)$^{-1}$. These risk values were then summed to provide a 2,3,7,8-TCDD Toxicity Equivalent (TEQ) risk. The TEFs used for the PCDD/PCDF congeners are listed in Table 19.

4.1.3.2 Lead and Mercury. Health issues related to lead exposure, in particular lead in soil as it pertains to children, are of concern to the general public. Therefore, the potential impact of lead exposure was assessed as described in the Guidance (USEPA 1998a). The potential for lead toxicity from direct inhalation or from ingestion of soil is not assessed using the conventional equations that utilize an RfC or an RfD. Rather, a biokinetic model for children is used to determine the health-protective concentration of lead in air or soil. Direct exposure (inhalation) to a child was assessed by comparing the estimated air concentration to the health-protective air concentration of 2×10^{-1} μg/m^3 (USEPA 1998a). Indirect exposure (ingestion of soil) was assessed by comparing the estimated concentrations in soil to a maximum concentration in soil of 100 mg/kg (USEPA 1998a). These are defined by the biokinetic model as the predictive concentration in air or soil that will result in blood concentrations less than 10 μg/dl in children so exposed. The results of this analysis are presented in Section 4.3.3.1.

Health issues related to exposure to mercury, in particular methylmercury in fish, are of concern to the general public. Because the fate and transport evaluation of mercury is more complex than for other chemicals, an additional analysis was conducted for mercury with results presented in Section 4.3.3.2. According to the USEPA Guidance (1998a), approximately 50% of mercury emissions are deposited on soil or surface water, with the remaining mercury entering the global cycle. Of this 50% deposited on the soil or surface water, a conservative estimate of 15% is predicted to be converted to methylmercury. Therefore, in accordance with USEPA Guidance (1998a), the additional analysis conducted for mercury assumed that 15% of the deposited mercury was methylmercury and the remaining 85% of the deposited mercury was in the form of elemental mercury or mercury salts.

4.1.3.3 Nickel. While estimates of potential emissions of nickel were determined for all three scenarios, the type of nickel compound was not specified in the emissions source data reviewed. Consequently, for evaluation of estimated ELCRs, nickel was assumed to be nickel subsulfide, the type of nickel with the highest cancer potency factor for nickel compounds. Nickel is considered a potential human carcinogen by the inhalation route only; therefore, the ELCR associated with exposure to nickel was assessed for the direct inhalation pathway only (USEPA 1998a). For the noncarcinogenic hazard assessment, nickel was assumed to be nickel soluble salts for noncarcinogenic hazard assessment and was assessed for all indirect ingestion pathways.

4.1.3.4 Chromium. Although potential estimates of emissions of chromium were determined for the ARFF and drill tower scenarios, the species of this metal was not specified in the emissions source data reviewed. For this risk assessment, chromium was assumed to exist solely as hexavalent chromium (Cr^{6+}) for evaluation of estimated ELCRs. Cr^{6+} is classified as a carcinogen by the inhalation route of exposure, but is not considered to be carcinogenic by the oral route of exposure (USEPA 1998a). Therefore, ELCR from exposure to Cr^{6+} was assessed only for the direct inhalation route. For the noncarcinogenic hazard assessment, chromium was also assumed to be Cr^{6+}. USEPA Guidance (1998a) recommends that chromium should be assumed to exist solely in the Cr^{6+} form; however, if the hazard index (HI) exceeds target levels through certain pathways (e.g., beef, milk, pork, chicken, eggs and fish), then the hazard may be recalculated substituting the toxicity values for trivalent chromium (Cr^{3+}). The rationale for the substitution is that Cr^{6+} is readily reduced to Cr^{3+} in biological tissues, and thus, "...chromium in biological materials is probably always trivalent" [Cassarett and Doull's Toxicology (1991) as cited by USEPA Guidance (1998a)].

4.1.3.5 Polycyclic Aromatic Hydrocarbons. The potential risks associated with exposure to PAHs were assessed in accordance with the TEF risk assessment approach outlined by USEPA (1993) as per the USEPA Guidance (1998a). Using this TEF approach, the PAHs potentially present in emissions from the Facility were characterized by their carcinogenic potency relative to benzo[a]pyrene, the most potent of the PAH congeners. Hence, the oral CSF listed for each PAH as reported by the USEPA Guidance (1998a) was derived by multiplying by the oral CSF of benzo[a]pyrene by its respective TEF. URF values were calculated using the adjusted CSF for each PAH, an inhalation rate of 20 m^3/day, and a human body weight of 70 kg. The PAHs included were modeled through the fate and transport pathways using their own specific physicochemical parameter values (Table 20). Noncancer effects of PAHs were evaluated using the RfD listed for the specific PAH (USEPA 1998a).

4.2 Exposure Assessment

Exposure assessment is the process of measuring or estimating the intensity, frequency, and duration of human exposure to an agent in the environment. According to the National Academy of Science (NAS 1983), an exposure assessment should consider the magnitude, duration, frequency, and route of exposure; the size and characteristics of the population exposed; and the uncertainties in the assumptions used and estimates made. This section of the risk assessment report provides a description of the procedures, based on USEPA (1998a) guidance, used to describe land use in the study area; to identify receptors; to estimate chemical concentrations in all relevant media; and to estimate intake for identified receptors.

4.2.1 Land Use Evaluation

A survey of demographic and land use information was conducted to identify activities of populations in the surrounding area of the Facility and to provide information on the number of individuals who may potentially be exposed to emissions from the firefighter training scenarios conducted at the Facility and the pathways for that exposure. The land use evaluation was also used to determine the likelihood that the receptors identified for this risk assessment could be located at the points of maximum modeled

Table 20 COPC-Specific Parameters

Chemical	CAS No	MW (g/mole)	Tm (K)	Vp (atm)	S (mg/L)	H (atm m^3/mol)	Da (cm^2/s)	Dw (cm^2/s)	Kow (unitless)	Koc (mL/g)
1,2,3,4,6,7,8,9-OCDD	3268-87-9	460.76	598.1	1.09E-15	7.40E-08	7.00E-09	1.06E-02	3.69E-07	3.89E+07	2.40E+07
1,2,3,4,6,7,8,9-OCDF	39001-02-0	444.76	531.1	4.93E-15	1.20E-06	1.90E-06	1.48E-02	3.78E-06	6.03E+08	3.72E+08
1,2,3,4,6,7,8-HPCDD	35822-46-9	425.31	537.1	4.22E-14	2.40E-06	7.50E-06	1.11E-02	3.89E-06	1.58E+08	9.77E+07
1,2,3,4,6,7,8-HPCDF	67562-39-4	409.31	509.1	1.75E-13	1.35E-06	5.30E-05	1.55E-02	3.99E-06	8.32E+07	5.13E+07
1,2,3,4,7,8-HXCDD	39227-28-6	390.87	546.1	1.33E-13	4.40E-06	1.20E-05	1.15E-02	4.12E-06	6.17E+07	3.80E+07
1,2,3,4,7,8-HXCDF	70648-26-9	374.87	498.6	3.16E-13	8.25E-06	1.40E-05	1.62E-02	4.23E-06	1.78E+07	1.10E+07
1,2,3,6,7,8-HXCDD	57653-85-7	390.87	558.1	4.74E-14	4.40E-06	1.20E-05	1.15E-02	4.12E-06	1.78E+07	1.10E+07
1,2,3,6,7,8-HxCDF	57117-44-9	374.87	505.1	2.89E-13	1.77E-05	6.10E-06	1.62E-02	4.23E-06	1.78E+07	1.10E+07
1,2,3,7,8,9-HXCDD	19408-74-3	390.87	516.1	6.45E-14	4.40E-06	1.20E-05	1.15E-02	4.12E-06	1.78E+07	1.10E+07
1,2,3,7,8-PECDD	40321-76-4	356.42	513.1	1.25E-12	1.20E-04	2.60E-06	1.21E-02	4.38E-06	4.37E+06	2.69E+06
1,2,3,7,8-PECDF	57117-41-6	340.42	498.1	3.58E-12	2.40E-04	6.20E-06	1.70E-02	4.51E-06	6.17E+06	3.80E+06
2,3,4,6,7,8-HXCDF	60851-34-5	374.87	512.1	2.63E-13	1.30E-05	1.00E-05	1.62E-02	4.23E-06	1.78E+07	1.10E+07
2,3,4,7,8-PECDF	57117-31-4	340.42	469.1	4.33E-12	2.36E-04	6.20E-06	1.70E-02	4.51E-06	8.32E+06	5.13E+06
2,3,7,8-TCDF	51207-31-9	305.98	500.1	1.17E-11	4.19E-04	8.60E-06	1.79E-02	4.85E-06	3.39E+06	2.09E+06
2-Methylnaphthalene	91-57-6	142.2	307.6	8.88E-05	2.54E+01	4.45E-04	6.29E-02	7.20E-06	5.25E+03	4.37E+03
Acenaphthene	83-32-9	154.21	368.1	4.93E-06	4.13E+00	1.84E-04	4.21E-02	7.19E-06	9.22E+03	4.90E+03
Acenaphthylene	208-96-8	152.2	362.5	3.82E-05	3.93E+00	1.14E-04	4.39E-02	7.07E-06	8.71E+03	6.92E+03
Acetaldehyde	75-07-0	44.05	149.6	ND	ND	ND	2.72E-01	1.33E-05	6.02E-01	9.53E-01
Anthracene	120-12-7	178.22	491.1	3.35E-08	5.73E-02	1.11E-04	3.24E-02	7.74E-06	2.95E+04	2.35E+04
Antimony	7440-36-0	121.75	903.1	ND	ND	ND	7.73E-02	8.96E-06	ND	ND
Arsenic	7440-38-2	74.92	1091	ND	ND	ND	1.07E-01	1.24E-05	ND	ND
Barium	7440-39-3	137.33	983	ND	ND	ND	7.14E-02	8.26E-06	ND	ND
Benzaldehyde	100-52-7	106.12	329.6	1.30E-03	3.30E+03	4.18E-05	7.07E-02	9.48E-06	3.00E+01	2.01E-01
Benzene	71-43-2	78.11	278.6	1.25E-01	1.78E+03	5.49E-03	1.17E-01	1.02E-05	1.37E+00	6.20E+01

Table 20 (continued)

Chemical	CAS No	MW (g/mole)	Tm (K)	Vp (atm)	S (mg/L)	H (atm m^3/mol)	Da (cm^2/s)	Dw (cm^2/s)	Kow (unitless)	Koc (mL/g)
Benzo(a)pyrene	50-32-8	252.3	452	6.43E-12	1.94E-03	8.36E-07	2.18E-02	5.85E-06	1.35E+06	9.69E+05
Benzo(g,h,i)perylene	191-24-2	276.34	551	1.32E-13	2.60E-04	1.40E-07	4.90E-02	5.65E-05	5.00E+06	1.58E+06
Benzo[a]anthracene	56-55-3	228.28	433	2.03E-10	1.28E-02	3.62E-06	2.47E-02	6.21E-06	4.77E+05	2.60E+05
Benzo[b]fluoranthene	205-99-2	252.32	441	1.06E-10	4.33E-03	6.18E-06	2.28E-02	5.49E-06	1.59E+06	8.36E+05
Benzo[k]fluoranthene	207-08-9	252.32	490	1.32E-12	8.00E-04	4.15E-07	2.28E-02	5.49E-06	1.56E+06	8.32E+05
Beryllium	7440-41-7	9.01	1560	ND	ND	ND	4.39E-01	5.08E-05	ND	ND
Cadmium	7440-43-9	112.41	594.1	ND	ND	ND	8.16E-02	9.45E-06	ND	ND
Chlorine	7782-50-5	71.9	172.1	ND	ND	ND	1.10E-01	1.27E-05	ND	ND
Chromium	7440-47-3	52.0	2173.1	ND	ND	ND	1.01E-01	4.63E-05	ND	ND
Chromium VI	18540-29-9	52.0	2173	ND	ND	ND	1.36E-01	1.58E-05	ND	ND
Chrysene	218-01-9	228.3	527.1	1.03E-11	1.94E-03	1.21E-06	2.48E-02	6.21E-06	5.48E+05	2.97E+05
Dibenz[a,h]anthracene	53-70-3	278.3	539.1	2.70E-14	6.70E-04	1.12E-08	1.80E-02	6.01E-06	3.53E+06	1.79E+06
Ethylbenzene	100-41-4	106.2	178.1	1.26E-02	1.73E+02	7.73E-03	7.65E-02	8.49E-06	1.33E+03	2.04E+02
Fluoranthene	206-44-0	202.3	383.1	1.07E-08	2.32E-01	9.33E-06	2.75E-02	7.18E-06	1.21E+05	4.91E+04
Fluorene	86-73-7	166.2	389.1	8.17E-07	1.86E+00	7.30E-05	3.63E-02	7.88E-06	1.47E+04	7.71E+03
Formaldehyde	50-00-0	30.0	365.1	5.10E+00	5.50E+05	2.78E-04	5.00E-01	1.74E-05	2.20E+00	2.62E+00
Furans	110-00-9	68.1	187.4	7.90E-01	1.00E+04	5.39E-03	1.04E-01	1.20E-05	2.29E+01	2.09E+01
Indeno[1,2,3-cd]pyrene	193-39-3	276.3	435	1.88E-13	1.07E-02	4.86E-09	1.90E-02	5.66E-06	8.22E+06	4.11E+06
Lead	7439-92-1	207.2	600.5	ND	ND	ND	5.43E-02	6.28E-06	ND	ND
Methyl Chloroform	71-55-6	133.4	242.7	1.63E-01	1.17E+03	1.86E-02	4.66E-02	9.56E-06	2.64E+02	1.35E+05
Methylene Chloride	75-09-2	84.9	178.1	4.87E-01	1.74E+04	2.38E-03	8.69E-02	1.25E-05	1.80E+01	1.00E+01
Naphthalene	91-20-3	128.2	353.3	1.17E-04	3.11E+01	4.82E-04	5.26E-02	8.92E-06	2.36E+03	1.19E+03
n-Hexane	110-54-3	86.2	177.7	2.00E-01	1.30E+01	1.12E+00	2.00E-01	7.77E-06	1.95E+03	4.79E+02

Table 20 (continued)

Chemical	CAS No	MW (g/mole)	Tm (K)	Vp (atm)	S (mg/L)	H (atm m^3/mol)	Da (cm^2/s)	Dw (cm^2/s)	Kow (unitless)	Koc (mL/g)
Nickel	7440-02-0	58.7	1828	ND	ND	ND	1.26E-01	1.46E-05	ND	ND
o-Xylene	95-47-6	106.2	248.1	1.06E-02	1.86E+02	6.05E-03	7.69E-02	8.44E-06	1.35E+03	2.41E+02
Phenanthrene	85-01-8	178.2	371.1	1.35E-03	1.28E+00	1.88E-01	3.33E-02	7.47E-06	3.55E+04	2.09E+04
Phenol	108-95-2	94.1	314	5.74E-04	9.08E+04	5.95E-07	8.27E-02	1.03E-05	3.00E+01	2.20E+00
p-Xylene	106-42-3	106.2	286.1	1.06E-02	1.86E+02	6.05E-03	7.61E+02	8.50E-06	1.48E+03	3.11E+02
Pyrene	129-00-0	202.2	429.1	5.59E-09	1.37E-01	8.25E-06	2.72E-02	7.14E-06	1.00E+05	6.80E+04
Selenium	7782-49-2	79.0	490.1	ND	ND	ND	1.03E-01	1.20E-05	ND	ND
Silver	7440-22-4	107.9	1233.6	ND	ND	ND	8.38E-02	9.71E-06	ND	ND
Styrene	100-42-5	104.1	242.5	8.21E-03	2.57E+02	3.33E-03	7.73E-02	8.77E-06	8.49E+02	9.12E+02
Tetrachloroethylene	127-18-4	165.9	251.1	2.42E-02	2.32E+02	1.73E-02	7.20E-02	8.20E-06	3.51E+02	2.65E+02
Toluene	108-88-3	92.1	178.1	3.71E-02	5.58E+02	6.13E-03	9.72E-02	9.23E-06	4.65E+02	1.40E+02
Vinyl Acetate	108-05-4	86.1	180.1	1.43E-01	2.24E+04	5.50E-04	9.94E-02	1.00E-05	5.00E+00	4.97E+00
Zinc	7440-66-6	65.4	692.6	ND	ND	ND	1.17E-01	1.36E-05	ND	ND

ND - No Data Available

Table 20 (continued)

Chemical	Kds (cm^3/g)	Kdsw (L/Kg)	Kdbs (cm^3/g)	ksg $(year)^{-1}$	Fv (unitless)	RCF	$Br_{root\ veg}$	Br_{ag}	Br_{forage}	Bv_{ag}
1,2,3,4,6,7,8,9-OCDD	2.40E+05	1.80E+06	9.60E+05	6.93E-02	1.69E-03	1.62E+05	6.77E-01	1.59E-03	1.59E-03	2.36E+06
1,2,3,4,6,7,8,9-OCDF	3.72E+06	2.79E+07	1.49E+07	6.93E-02	1.67E-03	1.34E+06	3.60E-01	3.26E-04	3.26E-04	2.28E+06
1,2,3,4,6,7,8-HPCDD	9.77E+05	7.33E+06	3.91E+06	6.93E-02	1.62E-02	4.79E+05	4.90E-01	7.05E-04	7.05E-04	9.10E+05
1,2,3,4,6,7,8-HPCDF	5.13E+05	3.85E+06	2.05E+06	6.93E-02	3.47E-02	2.91E+05	5.68E-01	1.02E-03	1.02E-03	8.30E+05
1,2,3,4,7,8-HXCDD	3.80E+05	2.85E+06	1.52E+06	6.93E-02	5.96E-02	2.31E+05	6.09E-01	1.22E-03	1.22E-03	5.20E+05
1,2,3,4,7,8-HXCDF	1.10E+05	8.22E+05	4.39E+05	6.93E-02	4.86E-02	8.88E+04	8.10E-01	2.50E-03	2.50E-03	1.62E+05
1,2,3,6,7,8-HXCDD	1.10E+05	8.22E+05	4.39E+05	6.93E-02	2.89E-02	8.88E+04	8.10E-01	2.50E-03	2.50E-03	5.20E+05
1,2,3,6,7,8-HxCDF	1.10E+05	8.22E+05	4.39E+05	6.93E-02	5.15E-02	8.88E+04	8.10E-01	2.50E-03	2.50E-03	1.62E+05
1,2,3,7,8,9-HXCDD	1.10E+05	8.22E+05	4.39E+05	6.93E-02	1.53E-02	8.88E+04	8.10E-01	2.50E-03	2.50E-03	5.20E+05
1,2,3,7,8-PECDD	2.69E+04	2.02E+05	1.08E+05	6.93E-02	2.19E-01	3.01E+04	1.12E+00	5.62E-03	5.62E-03	2.39E+05
1,2,3,7,8-PECDF	3.80E+04	2.85E+05	1.52E+05	6.93E-02	3.64E-01	3.93E+04	1.03E+00	4.61E-03	4.61E-03	9.75E+04
2,3,4,6,7,8-HXCDF	1.10E+05	8.22E+05	4.39E+05	6.93E-02	5.47E-02	8.88E+04	8.10E-01	2.50E-03	2.50E-03	1.62E+05
2,3,4,7,8-PECDF	5.13E+04	3.85E+05	2.05E+05	6.93E-02	2.63E-01	4.95E+04	9.65E-01	3.87E-03	3.87E-03	9.75E+04
2,3,7,8-TCDF	2.09E+04	1.57E+05	8.36E+04	6.93E-02	6.63E-01	2.48E+04	1.19E+00	6.51E-03	6.51E-03	4.57E+04
2-Methylnaphthalene	4.37E+01	3.27E+02	1.75E+02	ND	1.00E+00	2.29E+01	5.25E-01	2.74E-01	2.74E-01	4.17E-02
Acenaphthene	4.90E+01	3.67E+02	1.96E+02	2.45E+03	1.00E+00	2.69E+02	5.48E+00	1.98E-01	1.98E-01	5.07E+00
Acenaphthylene	6.92E+01	5.19E+02	2.77E+02	ND	1.00E+00	3.35E+01	4.84E-01	2.04E-01	2.04E-01	5.02E-02
Acetaldehyde	9.53E-03	7.15E-02	3.81E-02	ND	1.00E+00	6.46E+00	6.78E+02	5.19E+01	5.19E+01	ND
Anthracene	2.35E+02	1.76E+03	9.40E+02	5.50E-01	1.00E+00	6.49E+02	2.76E+00	1.01E-01	1.01E-01	2.90E+01
Antimony	4.50E+01	4.50E+01	4.50E+01	ND	ND	ND	3.00E-02	3.19E-02	2.00E-01	ND
Arsenic	2.90E+01	2.90E+01	2.90E+01	ND	ND	ND	8.00E-03	6.33E-03	3.60E-02	NA
Barium	4.10E+01	4.10E+01	4.10E+01	ND	ND	ND	1.50E-02	3.22E-02	1.50E-01	NA
Benzaldehyde	2.01E-01	1.51E+00	8.04E-01	ND	1.00E+00	9.50E+00	4.72E+01	5.42E+00	5.42E+00	5.00E-02
Benzene	6.20E-01	4.65E+00	2.48E+00	3.89E+00	1.00E+00	1.66E+01	2.67E+01	2.25E+00	2.25E+00	1.92E-03

Table 20 (continued)

Chemical	Kds (cm^3/g)	Kdsw (L/Kg)	Kdbs (cm^3/g)	ksg $(year)^{-1}$	Fv (unitless)	RCF	$Br_{root\ veg}$	Br_{ag}	Br_{forage}	Bv_{ag}
Benzo(a)pyrene	9.69E+03	7.27E+04	3.87E+04	4.77E-01	2.65E-01	1.22E+04	1.26E+00	1.11E-02	1.11E-02	2.25E+05
Benzo(g,h,i)perylene	1.58E+04	1.19E+05	6.32E+04	ND	6.46E-02	4.35E+03	2.75E-01	5.20E-03	5.20E-03	1.10E-01
Benzo[a]anthracene	2.60E+03	1.95E+04	1.04E+04	3.72E-01	8.81E-01	5.48E+03	2.11E+00	2.02E-02	2.02E-02	1.72E+04
Benzo[b]fluoranthene	8.36E+03	6.27E+04	3.34E+04	4.15E-01	8.22E-01	1.39E+04	1.66E+00	1.01E-02	1.01E-02	3.65E+04
Benzo[k]fluoranthene	8.32E+03	6.24E+04	3.33E+04	1.18E-01	1.49E-01	1.38E+04	1.66E+00	1.01E-02	1.01E-02	5.40E+05
Beryllium	7.90E+02	7.90E+02	7.90E+02	ND	ND	ND	1.05E-03	2.58E-03	1.00E-02	ND
Cadmium	7.50E+01	7.50E+01	7.50E+01	ND	ND	ND	6.40E-02	1.25E-01	3.64E-01	ND
Chlorine	ND	ND	ND .	ND	1.00E+00	ND	ND	ND	ND	ND
Chromium	1.80E+06	1.80E+06	1.80E+06	ND	ND	ND	4.50E-03	4.88E-03	7.50E-03	ND
Chromium VI	1.90E+01	1.90E+01	1.90E+01	ND	ND	ND	4.50E-03	4.88E-03	7.50E-03	ND
Chrysene	2.97E+03	2.23E+04	1.19E+04	2.53E-01	7.61E-01	6.10E+03	2.05E+00	1.87E-02	1.87E-02	5.97E+04
Dibenz[a,h]anthracene	1.79E+04	1.34E+05	7.16E+04	2.69E-01	1.10E-02	2.56E+04	1.43E+00	6.36E-03	6.36E-03	4.68E+07
Ethylbenzene	2.04E+00	1.53E+01	8.16E+00	2.53E+01	1.00E+00	6.52E+01	3.20E+01	6.07E-01	6.07E-01	1.53E-02
Fluoranthene	4.91E+02	3.68E+03	1.96E+03	5.75E-01	9.92E-01	1.92E+03	3.90E+00	4.46E-02	4.46E-02	1.56E+03
Fluorene	7.71E+01	5.78E+02	3.08E+02	7.58E+03	1.00E+00	3.83E+02	4.96E+00	1.51E-01	1.51E-01	2.10E+01
Formaldehyde	2.62E-02	1.96E-01	1.05E-01	6.72E+02	1.00E+00	6.73E+00	2.57E+02	2.46E+01	2.46E+01	4.65E-04
Furans	2.09E-01	1.57E+00	8.36E-01	0.00E+00	1.00E+00	1.16E+00	5.54E+00	6.34E+00	6.34E+00	4.65E-03
Indeno[1,2,3-cd]pyrene	4.11E+04	3.08E+05	1.64E+05	3.47E-01	7.00E-03	4.91E+04	1.19E+00	3.90E-03	3.90E-03	2.67E+08
Lead	9.00E+02	9.00E+02	9.00E+02	ND	ND	ND	9.00E-03	1.36E-02	4.50E-02	ND
Methyl Chloroform	1.35E+03	1.01E+04	5.40E+03	9.26E-01	1.00E+00	2.33E+01	1.73E-02	1.54E+00	1.54E+00	1.14E-03
Methylene Chloride	1.00E-01	7.50E-01	4.00E-01	9.03E+00	1.00E+00	8.46E+00	8.46E+01	7.29E+00	7.29E+00	5.11E-04
Naphthalene	1.19E+01	8.93E+01	4.76E+01	5.27E+00	1.00E+00	9.81E+01	8.23E+00	4.35E-01	4.35E-01	4.52E-01
n-Hexane	4.79E+00	3.59E+01	1.91E+01	2.03E+00	1.00E+00	1.11E+01	2.33E+00	4.86E-01	4.86E-01	9.66E-03

Table 20 (continued)

Chemical	Kds (cm^3/g)	Kdsw (L/Kg)	Kdbs (cm^3/g)	ksg $(year)^{-1}$	Fv (unitless)	RCF	$Br_{root\ veg}$	Br_{ag}	Br_{forage}	Bv_{ag}
Nickel	6.50E+01	6.50E+01	6.50E+01	ND	ND	ND	8.00E-03	9.31E-03	3.20E-02	ND
o-Xylene	2.41E+00	1.81E+01	9.64E+00	6.72E+02	1.00E+00	6.61E+01	2.74E+01	6.01E-01	6.01E-01	1.99E-02
Phenanthrene	2.09E+02	1.57E+03	8.35E+02	1.26E+00	1.00E+00	7.47E+02	3.58E+00	9.08E-02	9.08E-02	2.08E-02
Phenol	2.20E-01	1.65E+00	8.79E-01	2.53E+01	1.00E+00	9.50E+00	4.32E+01	5.42E+00	5.42E+00	3.52E+00
p-Xylene	3.11E+00	2.33E+01	1.24E+01	6.72E+02	1.00E+00	7.05E+01	2.27E+01	5.70E-01	5.70E-01	2.20E-02
Pyrene	6.80E+02	5.10E+03	2.72E+03	4.56E+04	9.95E-01	1.66E+03	2.44E+00	4.98E-02	4.98E-02	1.44E+03
Selenium	5.00E+00	5.00E+00	5.00E+00	ND	ND	ND	2.20E-02	1.95E-02	1.60E-02	ND
Silver	8.30E+00	8.30E+00	8.30E+00	ND	ND	ND	1.00E-01	1.38E-01	4.00E-01	ND
Styrene	9.12E+00	6.84E+01	3.65E+01	9.03E+00	1.00E+00	4.81E+01	5.28E+00	7.85E-01	7.85E-01	2.21E-02
Tetrachloroethylene	2.65E+00	1.99E+01	1.06E+01	7.03E-01	1.00E+00	2.75E+01	1.04E+01	1.31E+00	1.31E+00	1.66E-03
Toluene	1.40E+00	1.05E+01	5.60E+00	1.15E+01	1.00E+00	3.26E+01	2.33E+01	1.11E+00	1.11E+00	6.33E-03
Vinyl Acetate	4.97E-02	3.73E-01	1.99E-01	0.00E+00	1.00E+00	7.11E+00	1.43E+02	1.53E+01	1.53E+01	5.65E-04
Zinc	6.20E+01	6.20E+01	6.20E+01	ND	ND	ND	4.40E-02	7.20E-02	2.50E-01	ND

ND - No Data Available

Table 20 (continued)

Chemical	Bv_{forage}	Ba_{milk} (d/kg FW)	Ba_{beef} (d/kg FW)	Ba_{pork} (d/kg FW)	Ba_{egg} (d/kg FW)	$Ba_{poultry}$ (d/kg FW)	BCF_{fish} (L/kg FW tissue)	BAF_{fish} (L/kg FW)	$BSAF_{fish}$ (unitless)	F_w (unit-less)	MF
1,2,3,4,6,7,8,9-OCDD	2.36E+06	1.00E-03	5.43E-03	6.57E-03	2.05E+00	2.27E-01	ND	ND	1.00E-04	0.6	1
1,2,3,4,6,7,8,9-OCDF	2.28E+06	1.00E-03	5.43E-03	6.57E-03	1.64E+00	9.09E-02	ND	ND	1.00E-04	0.6	1
1,2,3,4,6,7,8-HPCDD	9.10E+05	1.00E-03	5.40E-03	6.57E-03	5.27E+00	1.77E+00	ND	ND	5.00E-03	0.6	1
1,2,3,4,6,7,8-HPCDF	8.30E+05	1.00E-03	5.43E-03	6.57E-03	4.32E+00	1.45E+00	ND	ND	5.00E-03	0.6	1
1,2,3,4,7,8-HXCDD	5.20E+05	6.00E-03	3.26E-02	3.94E-02	9.36E+00	8.32E+00	ND	ND	4.00E-02	0.6	1
1,2,3,4,7,8-HXCDF	1.62E+05	7.00E-03	3.80E-02	4.60E-02	9.32E+00	7.18E+00	ND	ND	4.00E-02	0.6	1
1,2,3,6,7,8-HXCDD	5.20E+05	5.00E-03	2.71E-02	3.29E-02	7.64E+00	5.32E+00	ND	ND	4.00E-02	0.6	1
1,2,3,6,7,8-HxCDF	1.62E+05	6.00E-03	3.26E-02	3.94E-02	9.36E+00	7.36E+00	ND	ND	4.00E-02	0.6	1
1,2,3,7,8,9-HXCDD	5.20E+05	5.00E-03	2.71E-02	3.29E-02	4.82E+00	2.86E+00	ND	ND	4.00E-02	0.6	1
1,2,3,7,8-PECDD	2.39E+05	1.00E-02	5.43E-02	6.57E-02	9.73E+00	1.14E+01	ND	ND	9.00E-02	0.6	1
1,2,3,7,8-PECDF	9.75E+04	2.00E-03	1.09E-02	1.31E-02	ND	ND	ND	ND	9.00E-02	0.6	1
2,3,4,6,7,8-HXCDF	1.62E+05	5.00E-03	2.71E-02	3.29E-02	5.59E+00	3.59E+00	ND	ND	4.00E-02	0.6	1
2,3,4,7,8-PECDF	9.75E+04	9.00E-03	4.89E-02	5.91E-02	1.16E+01	1.49E+01	ND	ND	9.00E-02	0.6	1
2,3,7,8-TCDF	4.57E+04	3.00E-03	1.63E-02	1.97E-02	7.45E+00	1.16E+01	ND	ND	9.00E-02	0.6	1
2-Methylnaphthalene	4.17E-02	1.32E-04	4.17E-05	1.58E-04	4.17E-02	4.17E-02	3.96E+02	ND	ND	0.6	1
Acenaphthene	5.07E+00	7.32E-05	2.31E-04	2.80E-04	7.32E-02	1.83E-04	6.07E+02	ND	ND	0.6	1
Acenaphthylene	5.02E-02	2.19E-04	6.92E-05	2.63E-04	6.92E-02	6.92E-02	5.81E+01	ND	ND	0.6	1
Acetaldehyde	ND	4.78E-09	1.51E-08	1.83E-06	4.78E-06	1.19E-08	4.00E-01	ND	ND	0.6	1
Anthracene	2.90E+01	2.34E-04	7.41E-04	8.98E-04	2.34E-01	5.85E-04	ND	2.60E+03	ND	0.6	1
Antimony	ND	1.00E-04	1.00E-03	ND	ND	ND	4.00E+01	ND	ND	0.2	1
Arsenic	ND	6.00E-05	2.00E-03	ND	ND	ND	2.00E+01	ND	ND	0.2	1
Barium	ND	3.50E-04	1.50E-04	ND	ND	ND	6.33E+02	ND	ND	0.6	1
Benzaldehyde	5.00E-02	2.38E-07	7.54E-07	9.12E-07	2.38E-04	5.95E-07	7.81E+00	ND	ND	0.6	1
Benzene	1.92E-03	1.09E-06	3.44E-06	4.17E-06	1.09E-03	2.72E-06	2.48E+01	ND	ND	0.6	1

Table 20 (continued)

Chemical	Bv_{forage}	Ba_{milk} (d/kg FW)	Ba_{beef} (d/kg FW)	Ba_{pork} (d/kg FW)	Ba_{egg} (d/kg FW)	$Ba_{poultry}$ (d/kg FW)	BCF_{fish} (L/kg FW tissue)	BAF_{fish} (L/kg FW)	$BSAF_{fish}$ (unitless)	F_w (unit-less)	MF
Benzo(a)pyrene	2.25E+05	1.07E-02	3.38E-02	4.10E-02	1.07E+01	2.67E-02	ND	9.95E+03	ND	0.6	1
Benzo(g,h,i)perylene	1.10E-01	1.26E-01	3.97E-02	1.51E-01	3.97E+01	3.97E+01	ND	ND	ND	0.6	1
Benzo[a]anthracene	1.72E+04	3.79E-03	1.20E-02	1.45E-02	3.79E+00	9.46E-03	ND	5.10E+03	ND	0.6	1
Benzo[b]fluoranthene	3.65E+04	1.27E-02	4.00E-02	4.84E-02	1.27E+01	3.16E-02	ND	9.95E+03	ND	0.6	1
Benzo[k]fluoranthene	5.40E+05	1.26E-02	3.98E-02	4.82E-02	1.26E+01	3.14E-02	ND	9.95E+03	ND	0.6	1
Beryllium	ND	9.00E-07	1.00E-03	ND	ND	ND	4.20E+01	ND	ND	0.6	1
Cadmium	ND	6.50E-06	1.20E-04	1.91E-04	2.50E-03	1.06E-01	2.50E+02	ND	ND	0.6	1
Chlorine	ND	1.50E-02	8.00E-02	ND	ND	ND	ND	ND	ND	0.6	1
Chromium	ND	1.50E-03	5.50E-03	ND	ND	ND	1.90E+02	ND	ND	0.6	1
Chromium VI	ND	1.50E-03	5.50E-03	ND	ND	ND	3.00E+00	ND	ND	0.6	1
Chrysene	5.97E+04	4.36E-03	1.38E-02	1.67E-02	4.35E+00	1.09E-02	NA	6.03E+03	ND	0.6	1
Dibenz[a,h]anthracene	4.68E+07	2.80E-02	8.86E-02	1.07E-01	2.80E+01	7.00E-02	ND	1.28E+04	ND	0.6	1
Ethylbenzene	1.53E-02	1.05E-05	3.33E-05	4.03E-05	1.05E-02	2.63E-05	1.39E+02	ND	ND	0.6	1
Fluoranthene	1.56E+03	9.65E-04	3.05E-03	3.69E-03	9.65E-01	2.41E-03	ND	1.57E+04	ND	0.6	1
Fluorene	2.10E+01	1.17E-04	3.70E-04	4.48E-04	1.17E-01	2.92E-04	ND	1.20E+03	ND	0.6	1
Formaldehyde	4.65E-04	1.75E-08	5.53E-08	6.69E-08	1.75E-05	4.36E-08	3.35E-01	ND	ND	0.6	1
Furans	4.65E-03	1.82E-07	5.75E-07	6.91E-07	1.82E-04	1.82E-04	6.36E+00	ND	ND	0.6	1
Indeno[1,2,3-cd]pyrene	2.67E+08	6.53E-02	2.07E-01	2.50E-01	6.53E+01	1.63E-01	ND	1.31E+04	ND	0.6	1
Lead	ND	2.50E-04	3.00E-04	3.60E-04	ND	ND	ND	8.00E+00	ND	0.6	1
Methyl Chloroform	1.14E-03	2.10E-06	6.63E-06	8.03E-06	2.10E-03	5.24E-06	4.08E+01	ND	ND	0.6	1
Methylene Chloride	5.11E-04	1.43E-07	4.52E-07	5.47E-07	1.43E-04	3.57E-07	5.30E+00	ND	ND	0.6	1
Naphthalene	4.52E-01	1.87E-05	5.92E-05	7.16E-05	1.87E-02	4.67E-05	2.15E+02	ND	ND	0.6	1
n-Hexane	9.66E-03	1.55E-05	4.90E-05	5.88E-05	1.55E-02	1.55E-02	1.86E+02	ND	ND	0.6	1

Table 20 (continued)

Chemical	Bv_{forage}	Ba_{milk} (d/kg FW)	Ba_{beef} (d/kg FW)	Ba_{pork} (d/kg FW)	Ba_{egg} (d/kg FW)	$Ba_{poultry}$ (d/kg FW)	BCF_{fish} (L/kg FW tissue)	BAF_{fish} (L/kg FW)	$BSAF_{fish}$ (unitless)	F_w (unit-less)	MF
Nickel	ND	1.00E-03	6.00E-03	ND	ND	ND	7.80E+01	ND	ND	0.6	1
o-Xylene	1.99E-02	1.07E-05	3.39E-05	4.10E-05	1.07E-02	2.68E-05	1.41E+02	ND	ND	0.6	1
Phenanthrene	2.08E-02	2.82E-04	8.92E-04	1.08E-03	2.82E-01	7.04E-04	ND	3.30E+03	ND	0.6	1
Phenol	3.52E+00	2.38E-07	7.54E-07	9.12E-07	2.38E-04	5.95E-07	7.81E+00	ND	ND	0.6	1
p-Xylene	2.02E-02	1.18E-05	3.72E-05	4.50E-05	1.18E-02	2.93E-05	1.51E+02	ND	ND	0.6	1
Pyrene	1.44E+03	7.98E-04	2.52E-03	3.06E-03	7.98E-01	1.99E-03	ND	1.19E+04	ND	0.6	1
Selenium	ND	5.86E-03	2.27E-03	1.88E-01	1.13E+00	1.13E+00	1.29E+02	ND	ND	0.2	1
Silver	ND	2.00E-02	3.00E-03	ND	ND	ND	2.04E+02	ND	ND	0.6	1
Styrene	2.21E-02	6.74E-06	2.13E-05	2.58E-05	6.74E-03	1.68E-05	9.91E+01	ND	ND	0.6	1
Tetrachloroethylene	1.66E-03	2.79E-06	8.82E-06	1.07E-05	2.79E-03	6.96E-06	5.06E+01	ND	ND	0.6	1
Toluene	6.33E-03	3.69E-06	1.17E-05	1.41E-05	3.69E-03	9.22E-06	6.27E+01	ND	ND	0.6	1
Vinyl Acetate	5.65E-04	3.97E-08	1.26E-07	1.52E-07	3.97E-05	9.92E-08	2.00E+00	ND	ND	0.6	1
Zinc	ND	3.25E-05	9.00E-05	1.28E-04	8.75E-03	8.75E-03	2.06E+03	ND	ND	0.6	1

ND - No Data Available

vapor and particle phase air concentration and modeled particle phase and particle-bound deposition concentrations, and could be exposed in the manner evaluated in this assessment. The demographic information for this section was obtained from a review of U.S. Geographical Survey maps (USGS 1994a-b, 1985a-b) and a site visit of the surrounding area.

The hypothetical facility was assumed to be located about 0.8 km north of the intersection of Louisiana Highway 33 and Arkansas Plant Road and approximately 12 km north of the city of Ruston, Louisiana in Lincoln Parish. The Lincoln Parish Municipal Landfill is approximately 0.5 km north of the facility. Two other small businesses, Noram Gas Tramission and Oceanic Energy, are also on Arkansas Plant Road to the north of the facility. No major industries are located in this area.

Residential dwellings are sparsely located on Arkansas Plant Road north of the facility and along the other roads in the area. The nearest resident was identified to be approximately 0.8 km (0.5 mile) north of the facility just off Arkansas Plant Road. No schools, day cares, retirement homes, or other establishment which would contain sensitive receptors was noted in the area. The majority of the individuals living within a 3 km radius of the facility are contained within the subdivisions of Copper Ridge and Stow Creek, located to the southwest and southeast of the facility, respectively. From a site visit it was estimated that fewer than 1000 people live within a 3 km radius of the facility. The density of population would increase to the south of the facility as portions of the city of Ruston would be included in the count. Moving farther out in the other three directions from the facility would include additional people, but the ratio of person per area would decline.

Figure 4 is a composite topographic representation of the area with the facility clearly identified.

Two cattle ranches, Max-JoAnn King Farms and T.D. Cattle Farm are within 3 km of the facility. Max-JoAnn King Farms is approximately 2.1 km to the east and T.D. Cattle Farm approximately 2.7 km to the southeast. No dairy farms, chicken houses, or swine production were noted within a 3 km radius of the facility during a site visit. While few gardens were noted during the site visit, it is reasonable to assume that a large proportion of the people living in this rural area would supplement their vegetable consumption with homegrown produce. The vegetables grown in this area would include, but not be limited to corn, peas, tomatoes, potatoes, squash, cucumbers, okra, watermelon, and cantaloupe. Based upon the site visit, it is reasonable to assume that some people would eat beef and vegetables potentially contaminated by emissions from the facility.

No significant natural surface waterbodies are in the area. Many small creeks are probably incapable of supporting a subsistence fisher. These waterbodies include Little Colvin Creek, Sixteen Branch, Beach Branch, Colvin Creek, and Cypress Creek. The nearest surface waterbody is a small creek approximately 1.5 km west of the facility. The creek runs in a south-to-north direction and has no name but it eventually feeds into Cypress Creek. For the purposes of this report the creek will be referred to as "Selected" creek. This creek was used as a potential waterbody that could sustain a subsistence fisher although it probably could not provide such a function. The creek was selected over the other waterbodies due to its proximity to the Facility and its watershed being in the downwind direction from the Facility such that it should receive the majority of the deposition for any training scenario. If no risk associated with the consumption of surface water or fish occurs using the "Selected" Creek, then it is expected that no risk would be associated with the selection of another waterbody in the area. The "Selected" Creek was also evaluated as a drinking water source though it could not actually serve that purpose. Drinking water is obtained from the Sparta Aquifer, and no surface waterbody in the immediate vicinity of the Facility could be used as a drinking water source.

4.2.2 Identified Receptors

There are numerous pathways by which people, who might live in the vicinity of the Facility in the future, could come in contact with chemicals that may be emitted from the training scenarios. Activities conducted at home, such as working in a garden (soil contact) or ingestion of vegetables grown in that garden, can result in exposure to chemicals contained in soil. Recreational activities such as swimming in nearby lakes, camping at nearby parks, or wading in streams could also result in contact with deposited chemicals. However, not all of these activities would result in the same level of exposure. Therefore, the intent of this assessment was to select those receptors and pathways that would be representative of the majority of the potential population and representative of the major ways in which that population could come in contact with deposited chemicals.

Seven hypothetical receptors have been selected which includes the six receptors specified in the USEPA guidelines (USEPA 1998a) and an industrial worker. It is expected that these receptors are most likely to have the highest estimated risks from exposure to emissions from the training scenarios. These receptors include a child and an adult resident, a subsistence farmer (adult and child), a subsistence fisher (adult and child), and an industrial worker. These receptors differ in: (1) the pathways by which they may become exposed to chemicals emitted from a facility; (2) the number of years of residency at or near the facility; (3) the consumption rates of contaminated foods; and (4) breathing rates and body weights. The pathways by which these receptors may be exposed are listed in Table 21.

Table 21. Receptor Pathways for Which Risks Are Calculated

Pathway	Subsistence Farmer (Adult and Child)	Subsistence Fisher (Adult and Child)	Resident (Adult and Child)	Industrial Worker
Inhalation	√	√	√	√
Soil Ingestion	√	√	√	
Produce Ingestion	√	√	√	
Beef Ingestion	√			
Milk Ingestion	√			
Pork Ingestion	√			
Chicken Ingestion	√			
Egg Ingestion	√			
Fish Ingestion		√		
Drinking Water Ingestion	√	√	√	

The adult resident and child are intended to be representative of persons in neighborhoods surrounding a facility who might engage in outdoor activities in which they would come in contact with soil or who might have a home garden as a source of some of their vegetable intake. Based upon a site visit, an estimated 1000 residents live within a 3 km radius of the Facility. Therefore, a minimal number of current residents are likely to be exposed to emissions from the Facility via the direct inhalation of vapors and particles, and by the indirect pathways involving the ingestion of homegrown vegetables, which represents only a portion of the total vegetables eaten; and the incidental ingestion of soil, which is assumed to happen daily. The adult and child resident receptor was placed at the location of the highest modeled vapor and particle phase air concentration off-site of the Facility property. This location should represent the maximum exposure for any current actual or potential future resident in the area. Any resident residing in a location other than the selected location would have less exposure.

The subsistence farmer: adult and child are assumed to raise cattle, pork, poultry, and to derive all of their vegetables from a home garden. They are assumed to be exposed by the direct inhalation of vapors and particles and by the consumption of homegrown vegetables, beef and milk, pork, poultry and eggs, surface water, and soil. It is assumed that all of the vegetables, beef, milk, pork, poultry, eggs, and soil ingested contain chemicals emitted from the training scenarios conducted at the Facility. As discussed previously, two cattle ranches were identified in the area and numerous home grown gardens potentilly exist. Therefore, a subsistence farmer -- i.e., someone for whom all vegetables, beef, milk, pork, and poultry products are impacted by Facility emissions -- is presently a plausible though unlikely scenario. However, as specified in USEPA (1998a) guidelines, it was assumed in this assessment that a potential future subsistence farmer was assumed to be exposed through all of these pathways. In order to represent a maximum exposed subsistence farmer, the location of the subsistence farmer was assumed to be at the same location as the adult resident. This location should represent a maximum exposure for any potential future subsistence farmer, with a subsistence farmer in another location having less exposure.

The subsistence fisher: adult and child have all of the demographic characteristics of the adult and child resident, are expected to be exposed by the same pathways (soil, vegetables, air) for 30 and 6 years, respectively, and are assumed to be located in the same area. In addition, the adult subsistence fisher is expected to fish in nearby waterbodies and to consume his entire fish consumption from waters receiving emissions from the Facility over a 30-year period. The child subsistence fisher is expected to consume his entire fish consumption from these waters for 6 years. The "Selected" Creek was selected for analysis as a waterbody where subsistence fishing may occur, although it probably cannot provide this function. The "Selected" Creek was selected because it should represent the waterbody with the highest modeled combined deposition. While many other waterbodies in the area may be fished recreationally, they (as with the "Selected" Creek) are probably too small and unproductive to be considered as a primary candidate for a subsistence fisherman. Placing the subsistence fisher at the same location as the adult resident should represent the maximum exposure for any potential future subsistence fisher, with a subsistence fisher in another location having less exposure.

The industrial worker was assumed to work at the training facility and be exposed to each of the training scenarios through the direct inhalation pathway only. This receptor was assumed to work at the Facility 8 hours per day, 5 days per week, and 50 weeks per year. It was assumed that the worker would be employed at the Facility for 30 years. An inhalation rate of 1.25 m^3/hr was used for the industrial worker.

The placement of the residential, subsistence farmer, and subsistence fisher was based on USEPA guidance (1998a). For this risk assessment, it was assumed that these receptors would not have the opportunity to live, fish, or raise vegetables and livestock within the fence line on the Facility itself. Rather, the residential adult and child scenarios were assessed at the location with the highest off-site air concentrations and deposition rates. The subsistence fisher adult and child and subsistence farmer adult and child were assumed to live in this same area. Determination of the concentrations of vapor and particles and dry and wet deposition is described in Section 3.

4.2.3 Exposure Estimates in Selected Media

The underlying premise of the risk assessment is that chemicals emitted from the Facility during fire training scenarios can be transported off-site in air and deposited onto nearby soil and surface waterbodies where human contact could occur through incidental ingestion of soil or use of surface water as a drinking water source. Further, chemicals deposited in soil are then available to be transported through the food chain by way of vegetables grown in the soil or become concentrated in beef or milk in cattle, in pork, or in poultry that feed on such vegetation and soil. Similarly, chemicals in surface water could bioaccumulate in fish, which could be a food source for some members of the surrounding population.

Determination of chemical concentrations in these various media (air, soil, surface water, vegetation, beef, milk, pork, poultry, eggs, and fish) is a complex process requiring consideration of the fate and transport of a chemical in these media and involving consideration of both site-specific characteristics and chemical-specific physicochemical properties. USEPA (1998a) guidance was used to estimate chemical concentrations in selected media and to estimate intake of chemicals for the identified receptors. The specific algorithms used to estimate chemical concentrations in selected media and values for chemical-, site-, and receptor-specific parameters applied in these algorithms are given in the section that follows.

As indicated in USEPA (1998a) guidance, certain site-related assumptions or parameters based on site-specific information are used. Documentation is provided in the following sections for site-specific data. Chemical-specific parameters have been provided in USEPA (1998a) for a number of chemicals that are usually evaluated in the process for combustion facilities. The same methodologies used to develop the parameters in the USEPA (1998a) guidance were used to develop the chemical-specific parameters for any chemical added to the analysis that were not included in USEPA (1998a) guidance.

The USEPA Guidance indicates that all chemicals with toxicity criteria values should be evaluated in all pathways; however, documentation from the USEPA has identified several chemical/pathway combinations that need not be evaluated. Selected not included in certain pathways in this risk assessment were

- Arsenic/fish ingestion; arsenic is rapidly incorporated into organic arsenical compounds, and as such does not elicit the toxicity associated with elemental arsenic (USEPA 1998b).

- PAHs/beef, milk, pork, poultry, and egg ingestion pathways; PAHs are not expected to accumulate in beef, pork, chicken, or eggs because PAH compounds are readily metabolized in animal tissues to water-soluble metabolites excreted from the body (USEPA 1998c, Gorelova and Cherepanova 1972, Gorelova *et al.* 1972).

- Chlorine/vegetation, pork, poultry, egg, and fish ingestion pathways; there are no biotransfer factors (factors that determine accumulation of chemicals in media) listed for chlorine in these pathways (USEPA 1998a).

- Arsenic, barium, beryllium, chromium, nickel, and silver/pork, poultry, and egg ingestion pathways; there are no biotransfer factors listed for these chemicals for these pathways (USEPA 1998a).

For the hay and wood used in the drill tower scenario, the chemicals, vanadium, copper, strontium, molybdenum, and tin, had RfDs but no chemical/physical properties for determining their fate and transport were available these compounds. Therefore, they were excluded from the analysis. The exclusion of these chemicals is expected to have little affect on the overall estimates of carcinogenic or noncarcinogenic risks.

4.2.3.1 Chemical Concentrations in Air. The chemical concentrations in air estimated for those chemicals emitted during training scenarios at the Facility were derived using Equation 11.

$$C_a = Q \cdot [F_v \cdot Cyv + (1 - F_v) \cdot Cyp] \qquad (11)$$

The total air concentration, C_a (μg/m^3), of each constituent was calculated based on the fraction of the chemical in the vapor phase F_v (unitless), the fraction of the chemical in the particle phase $1-F_v$ (unitless), the chemical emission rate, Q (g/s), and the normalized annual vapor phase and particle phase/bound air concentrations, Cyv and Cyp (μg·s/g·m^3).

Both F_v and Q are chemical-specific parameters. The values for F_v used for all chemicals were the default values specified in the USEPA (1998a) guidance or determined using equations specified in USEPA (1998a) guidance, and are provided in Table 20. The values for Q are listed in Tables 3 through 9 for the three training scenarios.

The maximum unitized vapor concentration (Cyv), particle phase (Cyp), and particle-bound phase (Cyp) outside the fence line were estimated by the ISCST3 or SCREEN3 model as discussed in Section 3. The particle phase values are used if the fraction of the chemical in the vapor phase is <0.05, otherwise the particle-bound values are used.

Results for the ARFF, propane system, and drill tower scenarios are presented in Appendex Tables 35a, 35b, and 35c, respectively.

4.2.3.2 Chemical Concentrations in Soil. According to USEPA (1998a) guidance, all receptors are assumed to come into contact with soil; therefore, incidental ingestion of soil is one of the routes of exposure for all receptors. (As stated in Section 4.2.2 the industrial worker, who is not listed in USEPA (1998a), was evaluated for exposure through the direct inhalation pathway only and is therefore not included in any of the indirect pathways.) Chemical concentrations in soil also contribute to the estimated concentrations in above ground vegetables, below ground vegetables, forage, silage, and grain and subsequently to concentrations of chemicals in beef, milk, pork, poultry, and eggs. Consequently, estimates of chemical concentrations in soil were used to estimate intake from the incidental ingestion of soil, ingestion of vegetables by human receptors, and the ingestion of beef, milk, pork, poultry, and eggs by human receptors.

Soil concentrations resulting from deposition (wet and dry) of particle phase/bound and vapor phase constituents onto soil over the duration of exposure for each specified receptor were estimated. These estimated soil concentrations also considered the loss from soil over that time period by natural processes such as leaching and runoff. Estimations of soil concentrations were calculated using the equations as described in the following paragraphs.

First, the deposition term, Ds (mg/kg·yr), was calculated using Equation 12.

$$Ds = \frac{100 \cdot Q}{Z_s \cdot BD} \cdot \left[Fv \cdot (0.31536 \cdot Vdv \cdot Cyv + Dywv) + (Dydp + Dywp) \cdot (1 - F_V) \right] \qquad (12)$$

The chemical emission rate, Q (g/s), as listed in Tables 3 through 9, was used in estimating the Ds.

The unitized yearly wet, Dywp ($s/m^2 \cdot yr$), and dry, Dydp ($s/m^2 \cdot yr$), particle deposition onto soil, the wet deposition of vapors to soil, Dywv ($s/m^2 \cdot yr$), and the diffusion of dry vapors to soil, Cyv ($\mu g \cdot s/g \cdot m^3$), were derived using the ISCST3 or SCREEN3 air model according to USEPA (1998a) guidance and as described in Section 3. A dry deposition velocity (Vdv) of 3 (cm/s) was assumed based on USEPA (1998a) guidance. Although the wet deposition of vapor and particles for these receptors was not at the same location as the air concentration and dry deposition, it was assumed to be co-located for this assessment.

Estimation of the term Ds also included consideration of the fraction of the chemical that is expected to remain in the vapor phase, F_v (unitless), which for metals was assumed to be zero and for organic chemicals was based on chemical-specific values (Table 20). The fraction of the chemical assumed to remain in the particle phase is $1-F_v$ (unitless). A chemical was assumed to be incorporated in a finite amount (depth) of soil, termed the mixing depth, Z_s (cm), at a fixed soil bulk density, BD (g/cm^3). The default value for Z_s was 1 cm and BD was 1.5 g/cm^3.

Next, the soil concentration (Cs_{tD}) for a specified deposition time (tD) was calculated using Equation 13.

$$Cs_{tD} = \frac{D_s \cdot (1 - \exp(-ks \cdot tD))}{ks} \tag{13}$$

Estimation of Cs_{tD} required specification of the number of years of Facility operation, i.e., the number of years over which deposition is expected to occur, tD (yr), which was assumed to be 30 years for all receptors. Calculation of Cs_{tD} also considered a loss term, ks (yr^{-1}), which represents the loss of contaminant from the soil erosion (kse), surface runoff (ksr) (equation 14), degradation (ksg),volatilization (ksv) (equation 15), and soil by leaching (ksl) (equation 16). With the exception of the ksv equation which was specified in USEPA 1999b, all equations were taken from USEPA (1998a). For these analyses, kse was set to zero (USEPA 1998a). That is, the soil erosion onto the Facility was assumed to be balanced by the soil erosion from the Facility (USEPA 1998a). The loss due to degradation, ksg, is a chemical-specific value (Table 20), specified in USEPA (1998a) guidelines for the majority of the chemicals included in the assessment. If a chemical was not listed in USEPA (1998a) and no suitable value of ksg could be identified, a conservative value of zero was assumed.

$$ksr = \frac{RO}{\theta_{sw} \cdot Z_s} \cdot \left[\frac{1}{1 + \left(Kd_s \cdot \frac{BD}{\theta_{sw}}\right)}\right] \tag{14}$$

$$ksv = \left[\frac{3.1536\times10^7 \cdot H}{Z_s \cdot Kd_s \cdot R \cdot T_a \cdot BD}\right] \cdot \left[0.482 \cdot W^{0.78} \cdot \left(\frac{\mu_a}{\rho_a \cdot D_a}\right)^{-0.67} \cdot \left(\sqrt{\frac{4\,A}{\pi}}\right)^{-0.11}\right] \tag{15}$$

$$ksl = \frac{P + I - RO - E_v}{\theta_{sw} \cdot Z_s \cdot \left[1.0 + \left(BD \cdot \frac{Kd_s}{\theta_{sw}} \right) \right]} \tag{16}$$

Several parameters required site-specific data. These site-specific parameters and values are listed in Table 22 and are discussed in the following paragraphs. When more than one value for a parameter was found, the value resulting in the higher soil concentration was selected. For example, with the leaching loss equation, the smaller ks becomes, thereby, resulting in a larger contaminant concentration in soil.

Table 22. Site-Specific Parameters Used in Estimating ks for Chemical Concentrations in Soil

Parameter	Description	Value	Source
P	Average annual precipitation (cm/yr)	131.2	Average precipitation in Monroe, Louisiana (NCDC 2001)
I	Average annual irrigation (cm/yr)	0	Irrigation is generally not performed. No data available.
RO	50% of average annual runoff (cm/yr)	21.6	Plate 21 (Geraghty *et al.* 1973)
E_v	50% of potential average annual evapotranspiration (cm/yr)	49.5	Plate 13 (Geraghty *et al.* 1973)

The following site-specific parameters were used to estimate ks:

- The average annual precipitation, P, in Ruston, Louisiana is 52 in/yr (131.2 cm/yr) (NCDC 2001)

- The average annual irrigation, I, is used in the estimation of ksl. Since the majority of the land surrounding the facility is wooded and very little agricultural activity was present in the area, a value of 0 for average annual irrigation was used in the ksl calculation.

- The average annual runoff, RO, used in the calculation of ksl and ksr, was determined from values for the Ruston area from the mean annual runoff for row crops in various types of soil. An average runoff value of 17 in/yr was reported in the *Water Atlas of the United States* (Geraghty *et al.* 1973). According to the USEPA (1998a) guidance, because the annual surface runoff, as cited, typically represents the total contribution, only 50% of the runoff term reported is assumed to be from surface runoff. Therefore, for this assessment, a value of 8.5 in/yr (21.6 cm/yr) or 50% of the maximum value found was used.

- A potential average annual evapotranspiration rate, E_v, of 39 in/yr for the northern portion of Louisiana was found in Geraghty et al. (1973) and assumed to be applicable to the Ruston area. According to USEPA (1998a), E_v is approximately 50% potential evapotranspiration (PEV). Therefore, 19.5 in/yr (49.5 cm/yr), which is 50% of the reported value, was used in estimating the leaching loss function, ksl.

Several chemical-specific parameters were required for the estimation of Cs_{tD}, primarily in the calculation of ks. Values for Kd_s (cm^3/g), soil-water partition coefficient, which is used in estimation of ksl, ksr, and ksv, for H ($atm{\cdot}m^3/mol$), Henry's Law constant, and for D_a (cm^2/s), diffusivity of contaminant in air, are found in Table 20. Other parameters, including BD and Z_s discussed above and the soil volumetric water content, θ_{sw}, the ambient air temperature, T_a, average annual wind speed, W, viscosity of air, μ_a, the density of air, ρ_a, and the surface area of the contaminated area.

Lastly, the average soil concentration over the exposure duration, Cs, was estimated using the output of the first two steps, Ds and Cs_{tD}. Equation 17 was used for the subsistence farmer scenario since its receptor-specific exposure duration (T_2), 40 years, was greater than the time period over which deposition occurred (tD). Equation 18 was used for the residential and fisher receptor scenarios.

$$Cs = \frac{\left(\frac{Ds \cdot tD - Cs_{tD}}{ks}\right) + \left(\frac{Cs_{tD}}{ks} \cdot [\, 1 - \exp(-ks \cdot (T_2 - tD))\,]\right)}{(T_2 - T_1)} \tag{17}$$

$$Cs = \frac{Ds}{ks \cdot (tD - T_1)} \cdot \left[\left(tD + \frac{\exp(-ks \cdot tD)}{ks} \right) - \left(T_1 + \frac{\exp(-ks \cdot T_1)}{ks} \right) \right] \tag{18}$$

Calculation of Cs in Equations 17 and 18 included consideration of the duration of operation of the Facility, tD (yr), which was assumed to be 30 years (for all receptors) with the receptor-specific exposure duration.

The parameter T_1 (yr) is defined as the year during which exposure to the receptor began. This parameter was set to zero years. Setting the parameter in this manner could be interpreted as assuming that exposure to the child occurred during the first 6 years of Facility operation; however, setting T_1 to 24 years, i.e., exposure during the last 6 years of Facility operation, produced the same value for Cs. Essentially, this equation assumes a steady-state between deposition and loss for any year of Facility operation.

Estimates of the chemical concentrations in soil for the ARFF, propane systems, and drill tower scenarios are presented in Appendix Tables 36a, 36b, and 36c, respectively.

4.2.3.3 Chemical Concentrations in Vegetables. Chemical concentrations were estimated for garden vegetables or produce that could be grown in the vicinity of the Facility and that could be a food source for the identified receptors. Concentrations were estimated for both aboveground and belowground produce.

The chemical concentration in aboveground produce due to direct deposition, Pd, was estimated using Equation 19.

$$Pd = \frac{1000 \cdot Q \cdot (1-Fv) \cdot [Dydp+(Fw{\cdot}Dywp)] \cdot Rp \cdot [1-\exp(-kp{\cdot}Tp)]}{Yp \cdot kp} \tag{19}$$

The direct deposition, Pd (mg/kg), was calculated using the value for chemical emissions, Q (g/s). The maximum off-site unitized yearly wet and dry particle phase and particle-bound deposition, Dywp and Dydp ($s/m^2{\cdot}yr$), were derived using the ISCST3 or SCREEN3 model, as discussed in Section 3. Chemical-specific parameters included consideration of the fraction of the chemical in the vapor phase, F_v (unitless), the fraction of the chemical in the particle phase, $1-F_v$ (unitless), and the fraction of wet deposition that adheres to the aboveground vegetation, Fw (unitless). These chemical-specific parameters are given in Table 20. Default parameters, as specified in the USEPA (1998a) guidance, used in Equation 19, include values for Rp (unitless), the interception fraction of the edible portion of the vegetable; kp (yr^{-1}), the plant surface loss coefficient; Tp (yr), the length of time of plant exposure to deposition; and Yp (kg DW/m^2), the yield of the edible portion of the vegetable. The values used were 0.39 for Rp, 18 yr^{-1} for kp, 0.164 yr for Tp, and 2.24 kg DW/m^2 for Yp.

The concentration in the aboveground plant due to direct uptake of vapor phase contaminants into plant leaves, Pv (mg/kg), was calculated using Equation 20.

$$Pv = Q \cdot Fv \cdot \frac{Cyv \cdot Bv_{ag} \cdot VG_{ag}}{\rho_a} \tag{20}$$

Again, the value for chemical emissions, Q (g/s), and the maximum off-site unitized vapor phase concentration, Cyv (μg·s/g·m^3) were used, as described in Section 4.2.3.2 for soil concentrations. Chemical-specific parameters included consideration of F_v (unitless), the fraction of chemical in the vapor phase, and the air-to-plant biotransfer factor, Bv_{ag} (unitless), which are found in Table 20. Default values for VG_{ag} (unitless), which is the correction factor for aboveground produce, are specified in USEPA (1998a) as 0.01 or 1.0, dependent upon the log K_{ow} of the chemical. A value of 1.2×10^3 g/m^3 was used for ρ_a (g/m^3), the density of air.

The parameter, Pr_{ag} (mg/kg), which is the concentration of contaminant in aboveground vegetation due to direct uptake from soil, is listed in Equation 21.

$$Pr_{ag} = Cs \cdot Br_{ag} \tag{21}$$

Pr_{ag} was based on both the concentration of contaminant in the soil, Cs (mg/kg), and the plant-to-soil bioconcentration factor (BCF), Br_{ag} (unitless). The soil concentration, Cs, was determined using Equations 12 to 18. For Cs, the site-specific, chemical-specific, and default parameter values used were the same as those required for calculation of the soil concentration. The chemical-specific values for Br_{ag}, are listed in Table 20.

The parameter, Pr_{bg} (mg/kg), which is the concentration of contaminant in belowground vegetation due to direct uptake from soil, is listed in Equation 22.

$$Pr_{bg} = Cs \cdot Br_{rootveg} \cdot VG_{rootveg} \tag{22}$$

Pr_{bg} was based on the concentration of contaminant in the soil, Cs (mg/kg), the plant-to-soil bioconcentration factor (BCF), $Br_{rootveg}$ (unitless), and an empirical correction factor, $VG_{rootveg}$ (unitless). Cs was determined for each receptor using Equations 12 to 18. For Cs, the site-specific, chemical-specific, and default parameter values used were the same as those required for calculation of the soil concentration. The chemical-specific values for the BCF, $Br_{rootveg}$, are listed in Table 20. The default values for $VG_{rootveg}$ are specified in USEPA (1998a) as 0.01 or 1.0, dependent upon the log K_{ow} of the chemical.

As stated, the chemical-specific values required for the above equations are listed in Table 20 and were provided in Appendix A of the USEPA (1998a) guidance. For those chemicals not included in the USEPA (1998a) guidance, the methodology reported in Appendix B of USEPA (1998a) was used to estimate these factors.

Estimates of chemical concentrations in vegetables for each of the scenarios are provided in Appendix Tables 37a, 37b, and 37c for the ARFF, propane system, and drill tower scenario, respectively.

4.2.3.4 Chemical Concentrations in Beef, Milk, Pork, Poultry, and Egg. To estimate the subsistence farmer's exposures from ingestion of locally grown beef, milk, pork, poultry, and eggs chemical concentrations in the environmental media to which the beef and dairy cattle, swine, and poultry may have been exposed were first estimated. Livestock could be exposed to chemicals emitted from the Facility via inhalation, through the incidental ingestion of soil while grazing, through ingestion of surface water, and through foraging or the ingestion of locally-grown feed crops. Of these routes of exposure, inhalation and water ingestion are considered the least significant contributors to tissue residues, in comparison with exposure through foraging or ingestion of feed crops and soil, and are not included in the concentration estimates. Chemical concentrations in beef, milk, pork, poultry, and eggs were estimated based on Equations 23 to 27.

$$A_{beef} = (\Sigma(F_i \cdot Qp_i \cdot P_i) + Qs \cdot Cs \cdot Bs) \cdot Ba_{beef} \cdot MF \quad (23)$$

$$A_{milk} = (\Sigma(F_i \cdot Qp_i \cdot P_i) + Qs \cdot Cs \cdot Bs) \cdot Ba_{milk} \cdot MF \quad (24)$$

$$A_{pork} = (\Sigma(F_i \cdot Qp_i \cdot P_i) + Qs \cdot Cs \cdot Bs) \cdot Ba_{pork} \cdot MF \quad (25)$$

$$A_{poultry} = (\Sigma(F_i \cdot Qp_i \cdot P_i) + Qs \cdot Cs \cdot Bs) \cdot Ba_{poultry} \quad (26)$$

$$A_{egg} = (\Sigma(F_i \cdot Qp_i \cdot P_i) + Qs \cdot Cs \cdot Bs) \cdot Ba_{egg} \quad (27)$$

The chemical concentrations (mg/kg) in beef (A_{beef}), milk (A_{milk}), pork (A_{pork}), poultry ($A_{poultry}$), and eggs (A_{egg}) were based on the amount of chemical ingested in soil, forage, silage, or grain and the biotransfer of the ingested amount to animal tissue, to milk, or to the egg. Chemical concentrations in forage, silage, and grain (P_i) were estimated using the same approach as that described for vegetables (Section 4.2.3.3). As with the evaluation of vegetables, total chemical concentrations in forage and silage were estimated based on direct deposition of chemicals onto exposed plant surfaces (Pd), as well as direct vapor uptake (Pv) and root uptake (Pr). The total chemical concentration in grain was estimated using only the root uptake (Pr). The quantity of plants eaten by the animal each day, Qp_i (kg plant tissue DW/day), and the fraction of the plant grown on impacted soil (F_i) were default values provided in the USEPA (1998a) guidance. The fraction of the plant grown in the impacted soil was assumed to be 1 (100%). Qp_i was set at 8.8 kg plant tissue DW/day for forage, 2.5 kg plant tissue DW/day for silage, and 0.47 kg plant tissue DW/day for grain for beef cattle. For dairy cattle the values of Qp_i used were13.2 kg plant tissue DW/day for forage, 4.1 kg plant tissue DW/day for silage, and 3.0 kg plant tissue DW/day for grain. Swine consume only silage and grain, so Qp_i values of 1.4 kg plant tissue DW/day and 3.3 kg plant tissue DW/day were assigned for each, respectively. Poultry consumed only grain, so the Qp value for both poultry and eggs was set to 0.2 kg plant tissue DW/day. The concentration of chemicals in soil, Cs, was estimated using Equations 12 to 18. The quantity of soil ingested, Qs (kg soil/day), was assumed to be 0.5 kg soil/day for beef cattle, 0.4 kg soil/day for dairy cattle, 0.37 kg soil/day for pork, and 0.022 kg soil/day for poultry, all of which are default values provided by USEPA (1998a) guidance. The soil bioavailability factor, Bs, was set to 1.0 in all cases. The metabolism factor, MF, was assumed to be 1.0 for all COCs.

Not all of the chemicals ingested in either soil, forage, silage, or grain will be transferred to beef or milk. The biotransfer factors (day/kg) for beef (Ba_{beef}), milk (Ba_{milk}), pork (Ba_{pork}), poultry ($Ba_{poultry}$), and eggs (Ba_{egg}) are chemical-specific values provided in the guidance and are listed in Table 20. The biotransfer factor is applied to the total mass of chemical ingested in either soil or plant per day. The biotransfer factors were provided in the USEPA (1998a) guidance.

Concentrations calculated for beef are contained in Tables 38a, 38b, and 38c; for milk in Tables 39a, 39b, and 39c; for pork in Tables 40a, 40b, and 40c; for poultry in Table 41a, 41b, and 41c; and for eggs in Tables 42a, 42b, and 42c for the ARFF, propane system, and drill tower scenarios of the Appendix, respectively.

4.2.3.5 Chemical Concentrations in Surface Water. Chemical emissions from the training scenarios may be deposited both on the land surrounding the Facility and on waterbodies near the Facility. Estimation of chemical concentrations in surface water requires the use of a complex set of fate and transport equations. The guidance (USEPA 1998a) presents equations to determine chemical concentrations in surface water and sediment and categorizes the calculations into two significant endpoints: (1) waterbody loads and (2) waterbody concentrations.

Estimation of chemical concentrations in surface waterbodies is the starting point for a number of scenarios for the HHRA in a combustion source risk assessment. For the HHRA, estimates of concentrations in surface water were used to estimate intake of surface water used as a drinking source and intake by way of a fish ingestion scenario. The surface waterbody selected for the human health evaluation was one that was also assumed to support subsistence fishing as a reasonable scenario either presently or in the future. While the "Selected" Creek could not be used as a drinking water source, for this assessment it was conservatively assumed that it would be. The "Selected" Creek was selected because of its close proximity to the Facility and its watershed lies in the downwind direction from the Facility.

Initially, a default watershed area of 16 km^2 was assumed. Essentially, a 4 × 4 km square was assumed, with the source (the centroid of the three scenarios) at the center of the square. USGS topographic maps (USGS 1994a-b, 1985a-b) were reviewed to determine what area within this default grid supplied runoff to the "Selected" Creek. From this, the site-specific total watershed area (A_L) and the area of the receiving waterbody

(A_W), the "Selected" Creek, was defined. The waterbody surface area for the "Selected" Creek, A_W, was assumed to be 1 % of the total watershed. A_L was defined as the surface area that is affected by deposition and that drains to the waterbody.

As stated in Section 3, the unitized watershed average concentrations were estimated using the ISCST3 model using a Cartesian grid with receptor nodes at 500 m intervals within the area. The area used to estimate these watershed values included those receptor nodes that followed the topographic boundary of the watershed area and resulted in the highest estimated values.

The total load of chemicals to the waterbody was calculated according to Equation 28.

$$L_T = L_{DEP} + L_{dif} + L_{RI} + L_R + L_E \tag{28}$$

USEPA (1998a) identified five pathways for contaminant loading to the waterbody: 1) direct deposition (L_{DEP}), 2) runoff from impervious surfaces within the drainage area (L_{RI}), 3) runoff from pervious surfaces within the drainage area (L_R), 4) soil erosion from the drainage area (L_E), and 5) direct diffusion (L_{dif}). The summation of the contribution from each of these pathways estimates the total waterbody load.

Direct deposition loads, L_{DEP} (g/yr), were calculated assuming that chemicals bound to airborne fine PM were deposited directly onto the water surface. To estimate direct deposition to a waterbody, Equation 29 was used.

$$L_{DEP} = Q \cdot [F_v \cdot Dywwv + (1 - F_v) \cdot Dytwp] \cdot A_w \tag{29}$$

The load to the waterbody from direct deposition was estimated using the chemical emission rates, Q (g/s), fraction in vapor phase, F_v (unitless), the waterbody surface area, A_w (m^2), the unitized watershed annual average wet deposition from vapor phase, Dywwv (s/m^2-yr), and the unitized watershed annual average total (wet and dry) deposition from particle or particle-bound phase, Dywtp (s/m^2-yr).

The waterbody surface area, A_w, was one of the parameters required for the calculation of total loads. The waterbody surface area of the "Selected" Creek was assumed to be 1% of the watershed based upon a review of the USGS maps (1994a-b, 1985a-b). Values for site-specific parameters used in estimating the total waterbody load are given in Table 23.

Table 23 Site-Specific Parameters Used in Estimating Total Waterbody Load for Human Health Receptors

Parameter	Description	Value	Source
R	50% of average annual runoff (cm/yr)	21.6	Geraghty *et al.* (1973), Plate 21
A_w	Waterbody area (m^2)	56,700	Assumed 1% of watershed was the "Selected" Creek
A_I	Impervious watershed area receiving pollutant deposition (m^2)	283,700	Assumed 5% of WA_I impervious
A_L	Total site-specific watershed area receiving pollutant deposition (m^2)	5,670,000	Representative watershed for the "Selected" Creek (USGS 1994a-b, 1985a-b)
RF	Universal Soil Loss Equation (USLE) rainfall (or erosivity) factor (erosion index units/yr)	375	Wischmeier and Smith (1978)

Diffusion loads, L_{dif}, were calculated assuming some transfer of atmospheric vapor phase chemical across the surface of the waterbody using Equation 30.

$$L_{Dif} = \frac{K_v \cdot Q \cdot F_v \cdot Cywv \cdot A_w \cdot 1 \times 10^{-6}}{H/(R \cdot T_{wk})} \tag{30}$$

Several parameters were included in the estimation of the diffusion load to waterbody. These included the chemical emission rates, Q (g/s), the fraction of each chemical's air concentration in the vapor phase, F_v (unitless) (Table 20), a calculated diffusive mass transfer coefficient, K_v (m/yr), the modeled unitized watershed annual average vapor phase air concentration, Cywv (μg·s/g·m^3), the site-specific waterbody surface area, A_w (m^2), chemical-specific Henry's Law constant, H (atm·m^3/mol) (Table 20), the universal gas constant, R (8.205×10^{-5} atm-m^3/mol-K), and a default waterbody temperature, T_{wk} (298 K).

For the remaining three types of loads considered, runoff from impervious and pervious surfaces and soil erosion, it was assumed that the chemicals deposited within the effective watershed area may all reach the "Selected" Creek by some pathway even though numerous other waterbodies could receive a portion of the surface runoff and erosion loads.

Loads from impervious surface runoff, L_{RI}, were calculated for a portion of the developed areas of the Facility that were assumed to drain into the "Selected" Creek. Impervious surfaces include paved areas such as parking lots and streets, and rooftops of homes and commercial or industrial buildings. While there are currently few impervious surfaces in the area of the Facility, in order to provide a more conservative assessment of future conditions, it was assumed that 5% of the watershed area was impervious. Equation 31 was used to estimate impervious runoff load.

$$L_{RI} = Q \cdot [F_v \cdot Dywwv + (1 - F_v) \cdot Dytwp] \cdot A_I \tag{31}$$

In estimating impervious runoff, the impervious watershed area, A_I (m^2) (Table 23), the chemical emission rates, Q (g/s), the fraction of air concentration in vapor phase, F_v (unitless) (Table 20), the unitized watershed average wet deposition from vapor phase, Dywwv ($s/m^2{\cdot}yr$), and the unitized watershed average total (wet and dry) deposition from particle phase, Dytwp ($s/m^2{\cdot}yr$) were used.

Before the remaining loads could be estimated, watershed soil concentrations must be estimated. Chemical concentrations in watershed soil, Cs_{ws}, were calculated as described in Section 4.2.3.2, with some exceptions. The unitized watershed average vapor phase air concentration (Cywv), the unitized watershed annual average wet deposition from vapor phase (Dywwv), and the unitized watershed annual average (wet and dry) deposition from particle or particle-bound phase (Dywtp) were used instead of Cyv, Dydp, Dywv, and Dywp. In calculating Cs_{ws}, a loss term, ks, as discussed previously in the estimation of chemical concentrations in soil for the other pathways, was considered. This term included loss of contaminant from the soil by leaching (ksl), soil erosion (kse), surface runoff (ksr), and volatilization (ksv). The terms ksr, ksv, and ksl were calculated as described in equations 14 through 16, and, as with calculation of Cs, ksg was a chemical-specific parameter for which USEPA (1998a) guidance provided values. The loss due to soil erosion, kse, was set to zero as per USEPA (1998a) guidance.

The load from pervious surfaces was estimated. Pervious surfaces are generally associated with exposed soil, grasslands, crop land, or forests. Loads from pervious surfaces are the chemical loads dissolved in runoff, while erosion loads are associated with soil particles suspended in runoff (USEPA 1998a). All dissolved chemicals in runoff (i.e., loads from pervious surfaces) were assumed to reach the waterbody. To estimate pervious runoff load, L_R, Equation 32 was used.

$$L_R = RO \cdot (A_L - A_I) \cdot \frac{Cs_{ws} \cdot BD}{\theta_{sw} + Kd_s \cdot BD} \cdot 0.01 \tag{32}$$

Pervious runoff load (L_R) was estimated using the site-specific average annual surface runoff (RO), the concentration of chemical in watershed soil (Cs_{ws}), a soil bulk density (BD) of 1.5 g/cm^3, the chemical-specific soil-water partition coefficient (Kd_s), the site-specific total watershed area receiving chemical deposition (A_L), the site-specific impervious watershed area receiving chemical deposition (A_I), and a volumetric soil water content of 0.2 mL water/cm^3 soil (θ_{sw}).

The soil erosion load from the land surface was coupled with predicted chemical concentrations in soil to determine chemical erosion loads to each waterbody using Equation 33.

$$L_E = X_e \cdot (A_L - A_I) \cdot SD \cdot ER \cdot \frac{Cs_{ws} \cdot Kd_s \cdot BD}{\theta_{sw} + Kd_s \cdot BD} \cdot 0.001 \tag{33}$$

In estimating the loss due to erosion, L_E, unit soil loss (X_e), the estimated concentration of chemical in watershed soils (Cs_{ws}), a soil bulk density of 1.5 g/cm^3 (BD), a volumetric soil water content of 0.2 mL water/cm^3 soil (θ_{sw}), chemical-specific soil-water partition coefficients (Kd_s) (Table 20), the site-specific total watershed area receiving chemical deposition (A_L), the impervious watershed area (A_I), the estimated sediment delivery ratio

(SD), and a soil enrichment ratio (ER) of 1 or 3 were used. The rainfall-erosivity factor (RF), a site-specific parameter used in the estimation of the unit soil loss (X_e), describes the erosive forces of rainfall and runoff. This parameter was determined for the area around Ruston, Louisiana, from Wischmeier and Smith (1978).

The final step in estimating surface water concentrations was to calculate total waterbody concentrations in each waterbody, including the water column and sediment, from the waterbody load. These concentrations are assumed to partition into the fraction of total waterbody concentration that occurs in the water column in dissolved and suspended phases, and that contained in bed sediment. Some chemical dissipation from within the waterbody was considered, specifically losses due to volatilization and burial in benthic sediment. Losses due to degradation and downstream transport were not considered. The equations used to estimate surface water concentrations assume steady-state concentrations in each waterbody. These equations assume complete mixing of the chemical constituent throughout the water column and sediment, and that sediment to water interactions are at equilibrium. Five additional site-specific parameters were needed to complete the estimation of chemical concentrations in surface water. These parameters and values are listed in Table 24.

To estimate total waterbody concentration, Equation 34 was used.

$$C_{wtot} = \frac{L_T}{Vf_x \cdot f_{wc} + k_{wt} \cdot A_w \cdot (d_{wc} + d_{bs})} \tag{34}$$

The total chemical load into the waterbody (L_T) was considered, including deposition, runoff, and erosion, as discussed previously, as well as the site-specific waterbody surface

Table 24. Site-Specific Parameters Used in Estimating Chemical Concentrations in Surface Water for Human Health Receptors

Parameter	Description	Value	Source
Vf_x	Average volumetric flow rate through waterbody (m^3/yr)	0	Conservatively assumed that the "Selected" Creek was essentially a lake.
d_w	Depth of water column (m)	2	Estimated depth of the creek
u	Current velocity (m/s)	0	Conservatively assumed that the "Selected" Creek was essentially a lake.
W	Wind velocity, 10 meters above water surface (meter/s)	4.04	Average wind speed from meteorological data.
TSS	Total suspended solids (mg/L)	10	USEPA (1994g) recommended default.

area (A_w), the site-specific depth of the water column (d_{wc}), and an upper benthic layer of 0.03 m (d_{bs}). The site-specific average volumetric flow rate through the waterbody (Vf_x) was assumed to be zero indicating that the creek was assumed to behave as a lake. The fraction of total waterbody chemical concentration that occurs in the water column (f_{wc}) was estimated. No information was available on the depth of the "Selected" Creek; therefore, the depth of the water column was assumed to be 2 m.

The estimated overall total waterbody dissipation rate constant (k_{wt}) was also estimated, which required calculation of two additional parameters, the water column volatilization loss rate constant (k_v) and the benthic burial rate (k_b). It also involved the use of several site-specific parameters, including the current velocity of the creek (u) (Table 24), the wind velocity above the water's surface (W) (Table 24), and the total suspended solids (TSS) in the river (Table 24). An average current velocity (u) of zero was used for the "Selected" Creek. Average wind velocity (W) was calculated from meteorological data used in Section 3.

The TSS concentration is the concentration of solids that is suspended in the water column. Since no suspended solids data were available for the "Selected" Creek, the default value, 10 mg/L, for TSS as recommended by USEPA (1994a) was used.

The total COC concentration in the water column (C_{wctot}) was calculated using Equation 35.

$$C_{wctot} = f_{wc} \cdot C_{wtot} \cdot \frac{d_{wc} + d_{bs}}{d_{wc}} \tag{35}$$

where f_{wc} (unitless) is the fraction of the total waterbody COC concentration in the water column, C_{wtot} (mg/L) is the total waterbody COC concentration (including water column and bed sediment), and d_{wc} (m) and d_{bs} (m) are the depth of the water column and benthic sediment layer. The value of C_{wtot} was calculated using Equation 34. The depth of the water column was assumed to be 2 m and the depth of the benthic layer was set at 0.03 m (USEPA 1998a default).

The concentration of COC dissolved in the water column (C_{dw}) was estimated using Equation 36.

$$C_{dw} = \frac{C_{wctot}}{1 + Kd_{sw} \cdot TSS \cdot 1 \times 10^{-6}} \tag{36}$$

C_{wctot} (mg/L) is the value calculated in Equation 35, Kd_{sw} (L/kg), the surface water partition coefficient, is a chemical-specific variable listed in Table 20, and TSS (mg/L), the total suspended solids concentration, is a site-specific parameter whose value is provided in Table 24.

Equation 37 was used to calculate the COC concentration sorbed to bed sediment.

$$C_{sb} = f_{bs} \cdot C_{wtot} \cdot \left(\frac{Kd_{bs}}{\theta_{bs} + Kd_{bs} \cdot C_{BS}} \right) \cdot \left(\frac{d_{wc} + d_{bs}}{d_{bs}} \right) \tag{37}$$

Where f_{bs} (unitless) is the fraction of total waterbody COC concentration in benthic sediment and is equivalent to (1 - f_{wc}); C_{wtot} (mg/L) is the total waterbody concentration calculated in Equation 34; Kd_{bs} (L/kg) is the chemical-specific value (Table 20) for the bed sediment/sediment pore water partition coefficient; θ_{bs} (unitless) is the bed sediment porosity whose default value is 0.6; C_{BS} (g/cm^3) is the bed sediment concentration whose default value is 1.0; and d_{wc} (m) and d_{bs} (m) are the depth of the water column and benthic sediment layer. The depth of the water column was 2 m and the depth of the benthic layer was set at 0.03 m (USEPA 1998a default).

Chemical concentrations in surface water are presented in Appendix Tables 43a, 43b, and 43c for the ARFF, propane system, and drill tower scenarios, respectively.

4.2.3.6 Chemical Concentrations in Fish. Since there are small waterbodies in the vicinity of the Facility from which people may fish, chemical concentrations in fish were estimated from chemical concentrations in the waterbody, which include either dissolved water column concentrations or sediment concentrations. Estimates of chemical concentrations in fish were calculated using Equations 38 to 40.

$$C_{fish} = C_{dw} \cdot BCF_{fish} \tag{38}$$

$$C_{fish} = C_{dw} \cdot BAF_{fish} \tag{39}$$

$$C_{fish} = \frac{C_{sb} \cdot f_{lipid} \cdot BSAF}{OC_{sed}} \tag{40}$$

Equation 38 and 39 estimate the chemical concentration in fish from dissolved water concentration, while Equation 40 estimates the chemical concentrations in fish from bed sediments. Underlying each of these equations is the estimation of the dissolved surface water concentrations and sediment concentrations based on the equations presented in Section 4.2.3.5 for the surface water pathway. Total waterbody concentration partitioned into dissolved water concentration and bed sediment concentration were calculated in Equations 35 to 37. Finally, the contaminant concentration in fish was calculated from the sum of Equations 38, 39, and 40 for those chemicals with bioconcentration factors (BCFs), bioaccumulation factors (BAFs), and biota-to-sediment accumulation factors (BSAFs). If a chemical did not have one of these parameters, the corresponding equation was not included in the sum. For example, most metals had only BCFs; therefore, estimated fish concentrations for these chemicals used only Equation 38. Many of the chemical-specific values for BCFs, BAFs, and BSAFs were provided in the USEPA (1998a) guidance.

Equation 40 contains two additional unitless parameters, f_{lipid} and OC_{sed}. Default values of 0.07 and 0.04 are provided in the USEPA (1998a) guidance for f_{lipid} and OC_{sed}, respectively.

Chemical concentrations in fish were only estimated for the subsistence fisher and child scenarios and are presented in Appendix Tables 44a, 44b, and 44c for the ARFF, propane system, and drill tower scenarios, respectively.

4.2.4 Estimates of Intake by Indirect Pathways

The calculation of COC-specific intake rates for each indirect exposure pathway, involves the COC media concentrations calculated using the equations in 4.2.3 and receptor-specific consumption rates, body weight, and frequency and duration of exposure. Average daily intakes (ADIs) of each chemical were calculated for each relevant receptor. Receptor-specific parameters used in estimating intake are listed in Table 25.

4.2.4.1 Ingestion of Soil. Incidental ingestion of soil may occur by children playing outdoors or by adults engaging in outdoor recreational activities, such as gardening. Exposure to a chemical through incidental soil ingestion was estimated using Equation 41.

$$I_{soil} = \frac{Cs \cdot CR_{soil} \cdot F_{soil}}{BW} \tag{41}$$

The amount ingested depends on the concentration of the chemical in soil, Cs (mg/kg) (Appendix Tables 36a, 36b, and 36c), the soil consumption rate, CR_{soil} (mg/day), which was assumed to be 100 mg/day for the subsistence farmer, subsistence fisher, and the adult resident, and 200 mg/day for the child scenarios, the fraction of ingested soil that was contaminated, F_{soil} (unitless), which was assumed to be 1 in all cases, and the receptor's body weight, BW (kg), which is 70 kg for adults and 15 kg for children (Table 25). The consumption rate (CR_{soil}) was dependent on the activity in which the individual was engaged and the age of the exposed individual; i.e., children were assumed to ingest more

Table 25 Receptor-Specific Parameters

Parameter	Description	Receptor					
		Subsistence Farmer		Subsistence Fisher		Resident	
		Adult	Child	Adult	Child	Adult	Child
CR_{soil}	Consumption rate of soil (kg/day)	0.0001	0.0002	0.0001	0.0002	0.0001	0.0002
F_{soil}	Fraction of consumed soil potentially containing COCs (unitless)	1	1	1	1	1	1
CR_{ag}	Consumption rate of aboveground vegetables (kg/kg-day DW)	0.0003	0.00042	0.0003	0.00042	0.0003	0.00042
F_{ag}	Fraction of consumed aboveground vegetables potentially containing COCs (unitless)	1	1	0.25	0.25	0.25	0.25
CR_{pp}	Consumption rate of protected aboveground produce (kg/kg-day DW)	0.00057	0.00077	0.00057	0.00077	0.00057	0.00077
CR_{bg}	Consumption rate of belowground produce (kg/kg-day DW)	0.00014	0.00022	0.00014	0.00022	0.00014	0.00022
CR_{beef}	Consumption rate of beef (kg/kg-day DW)	0.00114	0.00051	NA	NA	NA	NA
F_{beef}	Fraction of consumed beef potentially containing COCs (unitless)	1	1	NA	NA	NA	NA
Cr_{milk}	Consumption rate of milk (kg/day)	0.00842	0.01857	NA	NA	NA	NA
F_{milk}	Fraction of consumed milk potentially containing COCs (unitless)	1	1	NA	NA	NA	NA
CR_{pork}	Consumption rate of pork (kg/kg-day DW)	0.00053	0.000398	NA	NA	NA	NA
F_{pork}	Fraction of pork potentially containing COCs (unitless)	1.0	1.0	NA	NA	NA	NA
$CR_{poultry}$	Consumption rate of poultry (kg/kg-day DW)	0.00061	0.000425	NA	NA	NA	NA

Table 25 (continued)

Parameter	Description	Receptor					
		Subsistence Farmer		Subsistence Fisher		Resident	
		Adult	Child	Adult	Child	Adult	Child
$F_{poultry}$	Fraction of poultry potentially containing COCs (unitless)	1.0	1.0	NA	NA	NA	NA
CR_{eggs}	Consumption rate of eggs (kg/kg-day DW)	0.00062	0.000438	NA	NA	NA	NA
F_{eggs}	Fraction of eggs potentially containing COCs (unitless)	1.0	1.0	NA	NA	NA	NA
CR_{fish}	Consumption rate of fish (kg/kg-day FW)	NA	NA	0.00117	0.000759	NA	NA
F_{fish}	Fraction of consumed fish potentially containing COCs (unitless)	NA	NA	1	1	NA	NA
IR	Inhalation rate (m^3/hr)	0.63	0.30	0.63	0.30	0.63	0.30
CR_{DW}	Consumption rate of drinking water (L/day)	1.4	0.67	1.4	0.67	1.4	0.67
F_{DW}	Fraction of drinking water potentially containing COCs (unitless)	1	1	1	1	1	1
ED	Exposure duration (yr)	40	6	30	6	30	6
EF	Exposure frequency (days/yr)	350	350	350	350	350	350
ET	Exposure time (hr/day)	24	24	24	24	24	24
BW	Body weight (kg)	70	15	70	15	70	15
AT	Averaging time (yr)	70	70	70	70	70	70

NA: not applicable

Note: All values from the screening guidance (USEPA 1998).

soil than adults. Another important factor when considering soil intake, though not included in the Equation 41, is the relative oral bioavailability of the chemical from soil. This factor describes the fraction of chemical ingested that is absorbed, and because it was not included in the equation, it is assumed to have a value of one.

Results for soil intake are presented in Appendix Tables 45a, 45b, and 45c for the ARFF, propane system, and drill tower scenarios, respectively.

4.2.4.2 Ingestion of Vegetables. Vegetables may be contaminated via direct deposition, root uptake of chemical deposited on soil, or uptake of chemical from contaminated air for aboveground produce or via root uptake for belowground produce. Estimated chemical intake from vegetable ingestion was calculated using Equation 42.

$$I_{ag} = [((Pd + Pv + Pr_{ag}) \cdot CR_{ag}) + (Pr_{ag} \cdot CR_{pp}) + (Pr_{bg} \cdot CR_{bg})] \cdot F_{ag} \qquad (42)$$

Exposure to a chemical through vegetable intake depended on the chemical concentration in vegetables (mg/kg), the consumption rate of vegetables, CR_{ag}, CR_{pp}, and Cr_{bg} (day^{-1}), and the fraction of vegetables eaten that is contaminated, F_{ag} (unitless). The total chemical concentration in vegetables was the sum of the concentrations due to deposition (Pd), air-to-plant transfer (Pv), and root uptake (Pr) for aboveground vegetables; the concentration due to root uptake for above ground protected vegetables; and the concentration due to root uptake for belowground vegetables. The consumption rates (CR) for each receptor and each vegetable type are listed in Table 25. For purposes of the assessment, the fraction of vegetables contaminated varied depending on the receptor (Table 25). Another important parameter, which is not included in Equation 42, is the relative oral bioavailability of the chemical. Because it is not included in the equation, a value of one is assumed, indicating that no loss of chemical occurred during food preparation. All six off-site receptors were included in this assessment and receptor-specific values given in the USEPA (1998a) guidance were used.

Estimates of vegetation intake for the ARFF, propane system, and drill tower scenarios are presented in Appendix Tables 46a, 46b, and 46c, respectively.

4.2.4.3 Ingestion of Beef, Milk, Pork, Poultry, and Eggs. The estimated chemical intakes from ingestion of beef, milk, pork, poultry, and eggs were calculated as described in Equations 43 through 47.

$$I_{beef} = A_{beef} \cdot CR_{beef} \cdot F_{beef} \tag{43}$$

$$I_{milk} = A_{milk} \cdot CR_{milk} \cdot F_{milk} \tag{44}$$

$$I_{pork} = A_{pork} \cdot CR_{pork} \cdot F_{pork} \tag{45}$$

$$I_{poultry} = A_{poultry} \cdot CR_{poultry} \cdot F_{poultry} \tag{46}$$

$$I_{egg} = A_{egg} \cdot CR_{egg} \cdot F_{egg} \tag{47}$$

Exposure from chemicals in beef, milk, pork, poultry, and eggs, in addition to depending on the concentration (mg/kg) in these media (A_{beef}, A_{milk}, A_{pork}, $A_{poultry}$, A_{egg}) (Appendix Tables 38a-c to Table 42a-c), was a function of ingestion rate (kg/day) (CR_{beef}, CR_{milk}, CR_{pork}, $CR_{poultry}$, CR_{egg}), (Table 25) and the fraction (unitless) of beef, milk, pork, poultry, or eggs consumed that was assumed to contain chemicals (F_{beef}, F_{milk}, F_{pork}, $F_{poultry}$, F_{egg})

(Table 25). In this assessment, the relative oral bioavailability, not listed in Equations 43 to 47, was assumed to be one indicating no chemical loss was assumed to occur during food preparation. The subsistence farmer and subsistence farmer child were the only receptors included in this assessment.

Estimates of beef intake are presented in Tables 47a, 47b, and 47c; milk intake in Tables 48a, 48b, and 48c; pork intake in Tables 49a, 49b, and 49c; poultry intake in Tables 50a, 50b, and 50c; and egg intake in Tables 51a, 51b, and 51c for the ARFF, propane system, and drill tower scenarios in the Appendix, respectively.

4.2.4.4 Ingestion of Fish. Chemical concentrations in fish in waterbodies in the vicinity of the Facility were based on dissolved water column concentrations and sediment concentrations. Intake from fish ingestion was estimated using Equation 48.

$$I_{fish} = C_{fish} \cdot CR_{fish} \cdot F_{fish} \tag{48}$$

Exposure to chemicals from the ingestion of fish was a function of the chemical concentration in the fish, C_{fish} (mg/kg) (Appendix Tables 44a-c), the amount of contaminated fish consumed per day, Cr_{fish} (/day) (Table 25), and the fraction of consumed fish which was contaminated, F_{fish} (unitless) (Table 25). The bioavailability of the chemical from fish and the fraction of chemical concentration lost during food preparation were not quantified. The fraction of fish contaminated and the oral bioavailability were assumed to be one and no chemical loss was assumed during food preparation. The subsistence fisher and subsistence fisher child were the only receptors evaluated in this assessment.

Estimates of fish intake for the ARFF, propane system, and drill tower scenarios are presented in Appendix Tables 52a, 52b, and 52c, respectively.

4.2.4.5 Ingestion of Drinking Water. Although no waterbody in the area is currently a source of drinking water, a drinking water scenario was still assessed for receptors in the study area. For this scenario the conservative assumption was made that the "Selected" Creek could be used as a source of drinking water.

The estimated intake from ingestion of drinking water was calculated as described in Equation 49.

$$I_{dw} = \frac{C_{dw} \cdot CR_{dw} \cdot F_{dw}}{BW} \tag{49}$$

In addition to depending on the concentration of a chemical in the drinking water, C_{dw} (mg/L), the exposure was also a function of the consumption rate, CR_{dw} (L/day), the fraction of drinking water that was contaminated, F_{dw} (unitless), and the receptor-specific body weight, BW (kg). The USEPA recommended values of 1.4 L/day for adult receptors and 0.67 L/day for child receptors for the consumption rate and 1 for the F_{dw} were used in this analysis (USEPA 1998a). Values of 70 kg and 15 kg were used as the body weights of the adult and child receptors, respectively.

Estimates of intake of surface water are presented in Appendix Tables 53a, 53b, and 53c for the ARFF, propane systems, and drill tower scenarios, respectively.

4.2.5 Estimates of Intake for Indirect Pathways by Receptor

While estimates of COC-specific exposure rates for all indirect exposure pathways were determined using the equations presented in Section 4.2.4, all of the exposure pathways may not be complete for a potential receptor. The equations presented below estimate the daily intake of a COC via all indirect exposure pathways which are considered complete for the receptor under consideration.

Estimated intake for each of the indirect pathways is reported in the Appendix for each receptor, excluding the industrial worker which was assessed only through the direct inhalation pathway, in Tables 20a through 20f for the ARFF scenario, Tables 21a through 21f for the propane system scenario, and Tables 22a through 22f for the drill tower scenario. For the subsistence farmer adult and child, exposure to chemicals via ingestion of soil (I_{soil}) (calculated using Equation 41), vegetation (I_{ag}) (calculated using Equation 42), beef (I_{beef}) (calculated using Equation 43), milk (I_{milk}) (calculated using Equation 44), pork (I_{pork}) (calculated using Equation 45), poultry ($I_{poultry}$) (calculated using Equation 46), eggs (I_{egg}) (calculated using Equation 47), and drinking water (I_{dw}) (calculated using Equation 49) were estimated using Equation 50. Results of these calculations are presented in the Appendix Tables 54a, 55a, and 56a for the subsistence farmer and in Tables 54b, 55b, and 56b for the subsistence farmer child for the ARFF, propane system, and drill tower scenarios, respectively.

$$I = I_{soil} + I_{ag} + I_{beef} + I_{milk} + I_{pork} + I_{chicken} + I_{egg} + I_{dw} \qquad (50)$$

For the subsistence fisher adult and child, the indirect exposure pathways of ingestion of soil (I_{soil}) (calculated using Equation 41), vegetation (I_{ag}) (calculated using Equation 42), fish (I_{fish}) (calculated using Equation 48), and drinking water (I_{dw}) (calculated using Equation 49) were the pathways considered to contribute to total intake, using Equation 51. Results of these calculations are presented in Appendix Tables 54c, 55c, and 56c for the subsistence fisher and in Tables 54d, 55d, and 56d for the subsistence fisher child for the ARFF, propane system, and drill tower scenarios, respectively.

$$I = I_{soil} + I_{ag} + I_{fish} + I_{dw} \tag{51}$$

For both the adult and the child resident, the indirect pathways evaluated were ingestion of soil (I_{soil}) (calculated using Equation 41), ingestion of vegetation (I_{ag}) (calculated using Equation 42), and drinking water (I_{dw}) (calculated using Equation 49) using Equation 52. Results of these calculations are presented in Appendix Tables 54e, 55e, and 56e for the adult resident and in Tables 54f, 55f, and 56f for the subsistence child resident for the ARFF, propane system, and drill tower scenarios, respectively.

$$I = I_{soil} + I_{ag} + I_{dw} \tag{52}$$

4.3 Risk Characterization

4.3.1 Estimates of the Excess Lifetime Cancer Risks and Hazard Indices

Estimating the ELCR is the process of predicting the probability of cancer occurring in a population exposed to the estimated level of an identified carcinogen in an environmental media. The total estimated ELCR is the summation of the excess cancer risk associated with each identified carcinogen across all media. According to the USEPA Guidance (1998b), if the total estimated ELCR for each receptor is below one in 100,000 (1×10^{-5}) for all chemicals and all pathways evaluated for that receptor, then the release of emissions from training scenarios at the Facility are not expected to result in a significant increase in cancer risk above background. In this risk assessment, the ELCRs associated with exposure to chemicals that may be emitted from the firefighter training scenarios were estimated for both the direct and the indirect pathways for each receptor.

The process of estimating ELCRs is based on health-protective assumptions and involves combining the estimates of chemical intake discussed in Section 4.2.4 with the chemical-specific toxicity values for each identified carcinogen discussed in Section 4.1.2. The chemical-specific toxicity value, also called the CSF, is the upper bound dose associated with a cancer risk of 1 in one million and is derived from human epidemiology data and/or animal carcinogenicity studies. The methodology and assumptions used for deriving CSFs, and thus, estimates of ELCR using the CSFs are considered to be health-protective. The USEPA has stated that the true cancer risk may be lower and may even be zero (USEPA 1986).

The process of estimating the noncancer hazard involves calculating the ratio between the estimated chemical intake (Section 4.2.4) and a chemical-specific intake value, the RfD (Section 4.1.2). The RfD is an intake value derived from the most sensitive noncancer endpoint intended to be protective of sensitive subpopulations. The RfD is derived from the no adverse effect level (NOAEL, i.e., the dose at which no toxic effect is observed) for the most sensitive noncancer endpoint in the most sensitive species, which are identified by reviewing all of the available toxicity data (e.g., neurotoxicity, immunotoxicity, chronic toxicity, reproductive toxicity). The identified NOAEL for the most sensitive endpoint is then adjusted by dividing the NOAEL by UCFs. UCFs adjust the RfD to account for intra-species differences, inter-species differences, database limitations (e.g., lack of data on a specific endpoint such as neurotoxicity or reproductive toxicity), and sensitive populations. Hence, the RfD is assumed to be health protective for all noncancer endpoints and all populations. This ratio of intake to the RfD is referred to as the HQ for each identified chemical. HI is the sum of all HQ for all chemicals across all pathways for each receptor. According to USEPA Guidance, if the HI for all chemicals with the same target system (e.g., lung or liver) for each receptor is less than 1.0, then no significant off-site impact is expected from all emissions from a facility. As was done in estimating ELCR, noncancer hazards associated with exposure to chemicals that may be emitted during the training scenarios conducted at the Facility were estimated for both the direct and the indirect pathways for each receptor.

Estimates of ELCR or HQs, when exposure to chemicals occurs by the inhalation route, are typically derived by comparing the air concentration (in $\mu g/m^3$), to the URF [in $(\mu g/m^3)^{-1}$] or the RfC (in $\mu g/m^3$). However, for the multimedia, multipathway risk assessments, USEPA Guidance recommends that the method outlined below should be used. In this method, all exposures are expressed as an ADI, in units of mg/kg/day. The reason for this approach apparently is to compare exposures by the direct inhalation route and those that result from the indirect, oral pathways. The underlying assumption when using the URF or RfC is that exposure lasts for the lifetime of the individual. However, for this assessment, the exposure duration is not necessarily continuous and not for a lifetime (30 years for the resident and fisher adults, 40 years for the farmer, and 6 years for all child receptors). For some chemicals for which the URF or RfC may already be a derivation of the oral toxicity values, there are no conversion issues. However, when the URF and RfC are based upon inhalation studies, in particular when the lung is the target tissue, there are some recognized limitations with using the recommended approach. Nevertheless, for consistency with the USEPA Guidance, the recommended approach has been applied.

4.3.1.1 Direct Inhalation Exposure: Estimates of the Excess Lifetime Cancer Risks and HIs. The estimated ELCRs and HIs for the direct inhalation pathway are listed in Appendix Tables 53a, 53b, and 53c for the ARFF, propane systems, and drill tower scenarios, respectively. The ELCRs for the direct inhalation pathway for each receptor were estimated by multiplying the ADI (mg/kg-day) by the CSF [(mg/kg-day)$^{-1}$] for that chemical, as indicated in Equation 53.

$$\text{Cancer Risk}_{inh(i)} = \text{ADI} \cdot \text{CSF}_{inh(i)} \tag{53}$$

The ADI was calculated for each receptor according to Equation 54.

$$\text{ADI} = \frac{C_a \cdot \text{IR} \cdot \text{ET} \cdot \text{EF} \cdot \text{ED} \cdot 0.001}{\text{BW} \cdot \text{AT} \cdot 365 \text{ day/year}} \tag{54}$$

where

C_a = chemical-specific air concentration
IR = receptor-specific inhalation rate (m^3/hr)
ET = exposure time (hr/day)
EF = exposure frequency (days/yr)
ED = exposure duration (years)
BW= body weight (kg)
AT = averaging time (70 years)

The receptor-specific values for all adult receptor scenarios, excluding the industrial worker, were 0.63 m^3/hr (IR), 24 hr/day (ET), 350 days/yr (EF), 30 years (40 years for the subsistence farmer) (ED), and 70 kg (BW). For the industrial worker the values used were 1.25 m^3/hr (IR), 8 hr/day (ET), 250 days/yr (EF), 30 year (ED), and 70 kg (BW). For all child receptor scenarios, IR was 0.3 m^3/hr, ET was 24 hr/day, 350 days/yr (EF), ED was 6 years, and BW was 15 kg.

If a CSF was not available for the chemical but a URF was, then a CSF value was estimated according to Equation 55.

$$CSF_{inh(i)} = \frac{URF \cdot 70\ kg \cdot 10^3\ \mu g/mg}{20\ m^3/day} \tag{55}$$

For those chemicals classified as noncarcinogens, HQs were estimated using Equation 56.

$$HQ_{inh(i)} = \frac{ADI}{RfD} \tag{56}$$

Equation 56 is used to determine the ratio of the average daily intake (mg/kg-day) to the chemical's RfD (mg/kg-day). The ADI is determined using Equation 54 with the averaging time (AT) variable set equivalent to the exposure duration (ED).

Alternatively, for those chemicals for which an RfD was not available, an estimated RfD can be determined using Equation 57.

$$\mathrm{RfD} = \frac{\mathrm{RfC} \cdot 20\ \mathrm{m}^3/\mathrm{day}}{70\ \mathrm{kg}} \tag{57}$$

The total ELCR for the inhalation pathway was estimated using Equation 58.

$$\text{Total Cancer Risk}_{\mathrm{inh(i)}} = \sum_i \text{Cancer Risk}_{\mathrm{inh(i)}} \tag{58}$$

Cancer $\mathrm{Risk}_{\mathrm{inh(I)}}$ was the estimated ELCR value for each of the chemicals evaluated. The total cancer risk was estimated by summing the risk values for each individual chemical over each receptor.

HIs are determined for those chemicals classified as noncarcinogens using Equation 59.

$$\mathrm{HI}_{\text{target organ}} = \sum_i \mathrm{HQ}_i \tag{59}$$

4.3.1.1.1 ARFF Scenario. The ELCRs and noncancer HQs for the inhalation pathway from the burning of diesel, gasoline, aviation fuel, and kerosene for the ARFF training scenario are presented in Appendix Table 53a. As indicated in Table 1, this scenario was anticipated to burn 12,000 gal/ yr of each of the fuels with a single training exercise would be performed per day. As discussed in Section 2.1, because no data were available for gasoline, aviation fuel, or kerosene, and their emitted constituents are anticipated to be similar to that for diesel, No. 6 fuel oil emission factors were used as surrogates for all four fuels. These emission factors were obtained for the USEPA's Utility Report (USEPA 1998b) as described in detail in Section 2.1. As discussed in Section 3, the assumption was made that the fuel used during the daily training scenario was consumed over an hour's time period. Using this information and the equations presented in Section 4, an estimate of risk due to the inhalation of emissions from the conduct of the ARFF training scenario was determined for the six receptors specified in USEPA (1998a) and an industrial worker receptor. Receptor specific values used in the determination of the risk are presented in Table 25.

The total estimated ELCR for the inhalation pathway for the subsistence farmer adult (3.8×10^{-9}) was the highest of the seven receptors evaluated with the majority of the risk contributed by nickel (assumed to be nickel subsulfide). This ELCR indicates that if one billion persons were exposed as described, 4 extra cases of cancer would be expected over the lifetime of those one billion people, in comparison with the USEPA's benchmark level of 1 extra cancer in 100,000 persons so exposed. Estimates of excess lifetime risk are probability statements; therefore, this estimate can also be interpreted to mean that if an individual is so exposed over his or her lifetime, the probability of developing cancer is 4 in a billion.

The subsistence fisher and adult resident had estimates of 2.9×10^{-9} while all of the child receptors reported estimates of 1.3×10^{-9}. The subsistence farmer's risk was slightly higher than the other adult receptors because he was assumed to be exposed over a 40-year period as compared with a 30-year period for the other adult receptors. The total estimated ELCR for the industrial worker was 1.4×10^{-9}. Although the industrial worker is expected to be exposed to higher concentrations and deposition values due to being on-site, this estimate of ELCR for the inhalation pathway was less than the off-site receptors because it was assumed that he was exposed 250 d/yr and 8 hr/d, as compared with the off-site receptors being exposed for 350 d/yr and 24 hr/d. The HQ for each individual chemical was significantly less than 0.25 (with the largest being 1.4×10^{-7} for chlorine) and would remain less than 0.25, even if all were summed, rather than only adding the values for those chemicals affecting the same target organ, as indicated in USEPA (1998a).

4.3.1.1.2 Propane System Scenario. The ELCRs and noncancer HQs for the inhalation pathway from the burning of propane for the propane system training scenario are presented in Appendix Table 53b. As indicated in Table 1, in this scenario 90,000 lb/yr of propane were expected to be burned. As discussed in Section 2.2, emission factors for propane were obtained for the USEPA's Utility Report (USEPA 1998b) under the assumption that propane was identical to the natural gas for which the values had been estimated. As discussed in Section 3, since it is expected that there will be 25 training exercises per day, the assumption was made that the propane was burned continuously over an 8 hour period. Using this information and the equations presented in Section 4, an estimate of risk due to the inhalation of emissions from the propane system training scenario was determined for the six receptors specified in (USEPA 1998a) and an industrial worker receptor. Receptor specific values used in the determination of the risk are presented in Table 25.

The total estimated ELCR for the inhalation pathway for the subsistence farmer adult was the highest of the seven receptors evaluated, with a value of 3.9×10^{-11}. This value represents an estimated increase in risk of 4 in 100 billion persons exposed as described in comparison with the USEPA's benchmark level of 1 in 100,000. The subsistence fisher and adult resident had values of 2.9×10^{-11} while all of the child receptors reported values of 1.3×10^{-11}. These estimates (3 and 1 in 100 billion persons, respectively) are considered virtually zero since the world's population is currently 6 billion. The subsistence farmer's risk was slightly higher than the other adult receptor because he was assumed to be exposed over a 40-year period as compared with a 30-year period for the other adult receptors. The total estimated ELCR to the industrial worker was estimated to be 1.4×10^{-11}.

The HQ for each individual chemical was significantly less than 0.25 (with the largest being 2.4×10^{-9} for formaldehyde) and would remain less than 0.25, even if all were summed, rather than only adding the values for those chemicals affecting the same target organ.

4.3.1.1.3 Drill Tower Scenario. The ELCRs and noncancer HQs for the inhalation pathway from the burning of hay and wood during the drill tower training scenario are presented in Appendix Table 53c. As indicated in Table 1, 360,000 lb/yr of hay and 72,000 lb/yr of wood were expected to be burned, with the training exercise conducted 3 times per day. As discussed in Section 2.3, emission factors for hay were obtained from Jenkins *et al.* (1996) and emission factors for wood were obtained from USEPA (1990a). As discussed in Section 3, the assumption was made that 500 lb of hay and 100 lb of wood were burned during each training exercise with the exercise lasting one hour. It was assumed that one of the exercises occurred in the morning, another near noon, and the third in the afternoon. While each training exercise is expected to use 15 lb of propane (10,800 lb/yr), as demonstrated in Section 4.3.1.1.2, the contribution to risk from propane is insignificant, especially compared with that of hay and wood. Therefore, the use of propane was not quantified for the drill tower scenario. Using this information and the equations presented in Section 4, an estimate of risk due to the inhalation of emissions from the drill tower training scenario was determined for the six receptors specified in USEPA (1998a) and an industrial worker scenario. Receptor specific values used in the determination of the risk are presented in Table 25.

The total estimated ELCR for the inhalation pathway for the subsistence farmer adult was the highest of the seven receptors evaluated, with values of 2.2×10^{-8}. This represents an estimated increase in risk of 2 in 100 million persons exposed as described, in comparison with the USEPA's benchmark level of 1 in 100,000. The subsistence fisher and adult resident had estimates of 1.7×10^{-8}, whereas all of the child receptors reported estimates of 7.4×10^{-9}. The subsistence farmer's risk was slightly higher than the other adult receptor because he was assumed to be exposed over a 40-year period as compared with a 30-year period for the other adult receptors. The total estimated ELCR for the inhalation pathway for the industrial worker was estimated to be 7.8×10^{-9}.

The HQ for each individual chemical was significantly less than 0.25 (with the largest being 0.00005 for furans) and would remain less than 0.25, even if all were summed, rather than only adding the values for those chemicals affecting the same target organ.

4.3.1.2 Indirect Exposure: Estimates of the Excess Lifetime Cancer Risks and HIs. Estimated ELCRs from exposure to potential carcinogenic chemicals and potential hazards associated with exposure to noncarcinogens were estimated, resulting in upper bound ELCRs and HIs, respectively. The industrial worker was not evaluated through the indirect pathway, but was assumed to be exposed only through the direct inhalation pathway. In order to estimate ELCR from indirect exposure Equation 60 was used.

$$\text{Cancer Risk} = \frac{I \cdot ED \cdot EF \cdot CSF}{AT \cdot 365\ d/yr} \tag{60}$$

This equation considered the total daily intake of a chemical, I (mg/kg-day), for a receptor, the exposure duration (ED) in years for a receptor, an exposure frequency (EF) of 350 d/yr, the chemical-specific oral CSFs, an averaging time (AT) of 70 yrs, and a unit conversion factor of 365 d/yr. For ED, exposure was considered to last for 40 yrs for the subsistence farmer, 30 yrs for the subsistence fisher and the adult resident, and 6 yrs for the child receptors.

As with the direct inhalation pathway, risks from individual chemicals were summed within each exposure pathway in order to determine the total risk estimated for each pathway. Estimated risks for each applicable pathway were then summed for each receptor to estimate total risk for each of the six receptors, as with the estimated ELCR for the direct pathways (Equation 58).

For each noncarcinogen, a HQ was calculated as described in the USEPA (1998a) guidance. To estimate the HQ for each chemical from the intake, Equation 61 was used.

$$HQ = \frac{I \cdot ED \cdot EF}{RfD \cdot AT \cdot 365\ \text{days/year}} \tag{61}$$

In this equation I is the estimated total intake of a chemical in mg/day for a receptor, ED is the exposure duration (40 yrs for the subsistence farmer, 30 yrs for the adult resident and subsistence fisher, and 6 yrs for the child receptors), EF is the exposure frequency (350 d/yr), AT is the average time (set equal to ED), and RfD is the chemical-specific RfD in mg/kg/day (Table 19). Combined effects for a receptor were estimated by summing individual HQs for chemicals having the same target tissue or type of toxicity, as with the direct analysis. An HI<1 indicates that an adverse effect will not likely be observed. For purposes of this assessment, however, the screening comparison level was 0.25.

4.3.1.2.1 ARFF Scenario. Appendix Tables 54a through 54f presents the estimated total ELCRs through the indirect pathways from the burning of diesel, gasoline, aviation fuel, and kerosene for the ARFF training scenario. As indicated in Table 1, this scenario was anticipated to burn 12,000 gal/yr of each of the fuels with a single training exercise would be performed per day. As discussed in Section 2.1, since no data were readily available for gasoline, aviation fuel, or kerosene, and their emission are anticipated to be similar to that for diesel, No. 6 fuel oil emission factors were used as surrogates for all four fuels. These emission factors were obtained for the USEPA's Utility Report (USEPA 1998b) as described in detail in Section 2.1. As discussed in Section 3, the assumption was made that the fuel used during the daily training scenario was consumed over an hour's time period. Using this information and the equations presented in Section 4, an estimate of risk due indirect exposure to the emissions from the ARFF training scenario was determined for the six receptors specified in USEPA (1998a). Receptor- specific values used in the determination of the risk are presented in Table 25.

The total estimated ELCR from exposure by all indirect pathways for each receptor for the ARFF scenario was significantly less than 1 in 100,000, the benchmark for the risk assessment, as per the USEPA guidance (1998a) and was actually less than 1 in 100 million for all receptors. This ELCR indicates that there is less than one in 100 million chance (risk) that a person exposed to the estimated emissions from the ARFF training scenario would experience adverse effects.

Estimated total ELCRs for the subsistence farmer adult and child (Appendix Tables 54a and 54b) were slightly larger than the risks calculated for the resident and fisher receptors. The estimated ELCRs were 1.4×10^{-9} (1 in 1 billion) for the adult farmer receptor and 9.7×10^{-10} (1 in 1 billion) for the child receptor. For both farmer receptors, the major pathway contributing to risk was the ingestion of surface water pathway (an unlikely pathway for the area near the Facility due to the waterbody selected for analysis), which contributed 41% for the adult farmer and 24% for the child farmer. The milk ingestion pathway contributed approximately 9% to the indirect risk for the farmer child and 19% for the farmer adult. The beef, poultry, and egg pathways contributed approximately 10% each to the risk for the adult farmer.

The estimates of ELCR for the adult resident (Appendix Table 54e) and the subsistence fisher adult (Appendix Table 54c) were similar, 5.4×10^{-10} and 8.6×10^{-10}, respectively. The surface water pathway (an unlikely pathway for the area near the Facility due to the waterbody selected for analysis) contributed most of the estimated risk (98%), to the adult resident risk and 61% to the subsistence fisher risk. If the surface water pathway was excluded from the analysis, the risk to the adult resident would be 1.3×10^{-11}. The fish ingestion pathway contributed approximately 37% of the total estimated risk for the fisher adult. The resident child (Appendix Table 54f) and the fisher child (Appendix Table 54d) had total estimated ELCRs of 2.5×10^{-10} and 2.9×10^{-10}, respectively (approximately 3 in 10 billion). As with the adult resident and subsistence fisher, the surface water pathway (an unlikely pathway for the area near the Facility due to the waterbody selected for analysis) was the primary contributor, accounting for 96% of the risk in the child resident and 82% in the fisher child. The contribution to risk of the ingestion of fish pathway for the fisher child was 14%.

For all six receptors, none of the chemicals in any pathway either alone or considered together resulted in an HI greater than 0.25. For all receptors, chlorine had the highest HQ with results for all receptors between 0.002 and 0.0006 with the primary contribution to the HQ coming from the surface water pathway. As indicated previously, the surface water pathway was included in the analysis even though it is probably not a viable pathway for the Facility area. If the surface water pathway was not included then the highest HQ would be less than 0.00001.

4.3.1.2.2 Propane System Scenario. Appendix Tables 55a through 55f present the estimated total ELCRs through the indirect pathways from the burning of propane for the propane system training scenario. As indicated in Table 1, this scenario was anticipated to burn 90,000 lb/yr of propane, with the training exercise conducted 25 times per day. As discussed in Section 2.2, emission factors for propane were obtained for the USEPA's Utility Report (USEPA 1998b) under the assumption that propane was identical to the natural gas for which the values had been estimated. As discussed in Section 3, the assumption was made that the propane was burned continuously over an 8-hr period. Using this information and the equations presented in Section 4, an estimate of risk due indirect exposure to the emissions from the propane system training scenario was determined for the six receptors specified in USEPA (1998b). Receptor specific values used in the determination of the risk are presented in Table 25.

The total estimated ELCR from exposure by all indirect pathways for each receptor for the propane system scenario was significantly less than 1 in 100,000, the benchmark for the risk assessment, as per the USEPA guidance (1998a) and was actually less than 1 in 100 billion for all receptors. This result indicates that there is less than one in 100 billion chance (risk) that a person exposed to the estimated emissions from the propane system training scenario would experience adverse effects.

Estimated total ELCRs for the subsistence farmer adult and child (Appendix Tables 55a and 55b) were approximately 1.8×10^{-12} (2 in 1 trillion) for the adult receptor and 7.1×10^{-13} (7 in 10 trillion) for the child receptor. For both farmer receptors, the major pathway contributing to risk was the ingestion of surface water pathway (an unlikely pathway for the area near the Facility due to the waterbody selected for analysis) which contributed 91% for the farmer child receptor and 85% for the farmer adult receptor. The vegetation, beef, and milk ingestion pathways were the only other major contributors to the indirect risk.

The estimates of ELCR for the adult resident (Appendix Table 55e) and the subsistence fisher adult (Appendix Table 55c) were 1.5×10^{-12} and 3.2×10^{-12}, repectively. The surface water pathway accounted for most of the risk (97% for the adult resident), with the vegetation and soil pathway providing minor contributions. If the surface water pathway were excluded from the analysis, the risk to the adult resident would be 4.8×10^{-14}. The fish ingestion pathway contributed 53% of the total estimated risk for the fisher adult with the surface water pathway contributing 46%. The resident child (Appendix Table 55f) and the fisher child (Appendix Table 55d) had total estimated ELCRs of 6.6×10^{-13} and 8.8×10^{-13}, respectively. As with the adult resident and subsistence fisher, the surface water pathway (an unlikely pathway for the area near the Facility due to the waterbody selected for analysis) was the primary contributor accounting for 98% of the risk in the resident receptor and 73% in the fisher receptor. The contribution to risk of the ingestion of fish pathway for the fisher child was 25%.

For all six receptors, none of the chemicals in any pathway either alone or considered together resulted in an HI greater than 0.25. For all receptors, arsenic had the highest HQ with the largest result being 2.2×10^{-8} for the subsistence fisher child.

4.3.1.2.3 Drill Tower Scenario. The estimated total ELCRs through the indirect pathways from the burning of hay and wood for the drill tower training scenario are presented in Appendix Tables 56a through 56f. As indicated in Table 1, this scenario was anticipated to burn 360,000 lb/yr of hay and 72,000 lb/yr of wood, with the training exercise conducted 3 times per day. As discussed in Section 2.3, emission factors for hay were obtained from Jenkins *et al.* and emission factors for wood were obtained from USEPA (1990a). As discussed in Section 3, the assumption was made that 500 lb of hay and 100 lb of wood were burned during each training exercise with the exercise lasting one hour. It was assumed that one of the exercises occurred in the morning, another near noon, and the third in the afternoon. While each training exercise uses 15 lb of propane (10,800 lb/yr), as demonstrated in Section 4.3.1.2.2 the contribution to risk from propane is insignificant, especially compared with that of hay and wood. Therefore, the use of propane was not quantified for the drill tower scenario. Using this information and the equations presented in Section 4, an estimate of risk due indirect exposure to the emissions from the drill tower training scenario was determined for the six receptors specified in USEPA (1998a). Receptor specific values used in the determination of the risk are presented in Table 25.

The total estimated ELCR from exposure by all indirect pathways for each receptor for the drill tower scenario was less than 1 in 100,000, the benchmark for the risk assessment, as per the USEPA guidance (1998a) and was actually less than 1 in a million for all receptors. This value indicates that less than one in a million chance (risk) that a person exposed to the estimated emissions from the drill tower training scenario would experience adverse effects.

Estimated total ELCRs for the subsistence farmer adult and child (Appendix Tables 56a and 56b) were slightly larger than that the estimated risks calculated for the resident and fisher receptors. The estimated ELCRs were approximately 4.1×10^{-7} (4 in 10 million) for the adult farmer receptor and 1.3×10^{-7} (1 in 10 million) for the child farmer receptor. For the adult farmer and child farmer receptors, the major pathway contributing to risk was the milk ingestion pathway which contributed 41% to the adult farmer risk and 37% to the child farmer risk. The vegetation ingestion pathway was also a significant contributor at 30% for the adult farmer receptor and 22% for the child farmer receptor.

The estimates of ELCR for the adult resident (Appendix Table 56e) and the subsistence fisher adult (Appendix Table 56c) were similar, 1.1×10^{-7} and 2.5×10^{-7}, respectively, approximately a risk of 1 in 10 million and 3 in 10 million compared with the benchmark level of 1 in 100,000. The surface water ingestion pathway accounted for most of the risk (71%), with the vegetation ingestion pathway contributing approximately 24%

and the soil ingestion pathway having a minor contribution (<5%) for the adult resident. The fish ingestion pathway contributed approximately 57% of the total estimated risk for the fisher adult with the surface water ingestion pathway contributing 30% and the vegetation ingestion pathway contributing 10%. The resident child (Appendix Table 56) and the fisher child (Appendix Table 56d) had total estimated ELCRs of 5.0×10^{-8} and 6.8×10^{-8}, respectively. For the child resident the surface water ingestion pathway was the major contributor to risk accounting for 67% while the soil ingestion and vegetation ingetion pathways contributed 19% and 14%, respectively. The contribution to risk of the ingestion of fish pathway for the fisher child was only 26% with the surface water and vegetation ingestion pathways contributing 49% and 14%, respectively.

For all six receptors, chlorine had the highest HQ with a maximum value of 0.063 for the child receptors which is less than the USEPA's recommended screening benchmark level of 0.25. While the screening benchmark level is used as a comparison level to an HQ, the target level is used for comparisons with HI, or the sum of HQs which effect the same target organ. Since all other compounds have a HQ of less than 0.1. This HQ results from the inclusion of the ingestion of surface water pathway. As stated numerous times, the ingestion of surface water pathway is probably not applicable for the Facility area since the "Selected" Creek could not be used as a drinking water source.

4.3.1.3 Summary of Human Health Risks. For this analysis carcinogenic risk and noncarcinogenic hazards associated with the burning of materials during the three training scenarios at the Facility were assessed for the direct inhalation pathway and the indirect pathways – ingestion of soil, vegetation, beef, milk, poultry, eggs, fish, and surface water. While many of the indirect pathways may not be currently applicable to the area surrounding the Facility, they were assessed to provide an upper bound on any potential human health risks that might occur in the future due to the training scenarios. A summary of the overall risks for each scenario is presented in Table 26 for the direct inhalation pathway and Table 27 for the indirect pathways.

Table 26. Summary of Direct Inhalation Risks for All Scenarios

Receptor	ARFF	Propane System	Drill Tower	Total
Subsistence Farmer	3.8×10^{-9}	3.9×10^{-11}	2.2×10^{-8}	2.6×10^{-8}
Subsistence Farmer Child	1.3×10^{-9}	1.3×10^{-11}	7.4×10^{-9}	8.7×10^{-9}
Subsistence Fisher	2.9×10^{-9}	2.9×10^{-11}	1.7×10^{-8}	2.0×10^{-8}
Subsistence Fisher Child	1.3×10^{-9}	1.3×10^{-11}	7.4×10^{-9}	8.7×10^{-9}
Adult Resident	2.9×10^{-9}	2.9×10^{-11}	1.7×10^{-8}	2.0×10^{-8}
Child Resident	1.3×10^{-9}	1.3×10^{-11}	7.4×10^{-9}	8.7×10^{-9}
Industrial Worker	1.4×10^{-9}	1.4×10^{-11}	7.8×10^{-9}	9.2×10^{-9}

Table 27. Summary of Indirect Risks for All Scenarios

Receptor	ARFF	Propane System	Drill Tower	Total
Subsistence Farmer	1.4×10^{-9}	1.8×10^{-12}	4.1×10^{-7}	4.1×10^{-7}
Subsistence Farmer Child	9.7×10^{-10}	7.1×10^{-13}	1.3×10^{-7}	1.3×10^{-7}
Subsistence Fisher	8.6×10^{-10}	3.2×10^{-12}	2.5×10^{-7}	2.6×10^{-7}
Subsistence Fisher Child	2.9×10^{-10}	8.8×10^{-13}	6.8×10^{-8}	6.8×10^{-8}
Adult Resident	5.4×10^{-10}	1.5×10^{-12}	1.1×10^{-7}	1.1×10^{-7}
Child Resident	2.5×10^{-10}	6.6×10^{-13}	5.0×10^{-8}	5.0×10^{-8}

For the direct inhalation pathway, the subsistence farmer had the highest estimated total ELCRs with a value of 2.6×10^{-8} or approximately 3 in 100 million for all three scenarios. The drill tower scenario contributed 85% of the estimated risk, the ARFF scenario 15%, and the propane system less than 1%.

For the indirect pathways, the receptor with the highest estimated total ELCR for all three scenarios combined was the subsistence farmer. For all three scenarios, the subsistence farmer's estimated total ELCR was 4.1×10^{-7} or 4 in 10 million. The drill tower scenario contributed the majority of the estimated risk with the ARFF and the propane systems scenarios' contribution being insignificant.

Combining the direct inhalation and indirect pathway estimated lifetime cancer risk for the subsistence farmer resulted in a value is 4.1×10^{-7}. The value is still approximately 4 in 10 million. This total estimated ELCR can be viewed two ways: (1) on a population basis this infers that 4 extra cancers above the background rate would be expected in a population of 10 million persons so exposed by all of these pathways, media, and chemicals for a 70 year lifetime; and (2) for any individual so exposed over a 70-year lifetime, there is a 4 in 10 million chance of an extra cancer risk.

As discussed in Sections 4.3.1.2.1 for the ARFF scenario, 4.3.1.2.2 for the propane system scenario, and 4.3.1.2.3 for the drill tower scenario, none of the estimated noncarcinogenic HQ levels was above the 0.25 USEPA screening comparison level. In fact, the sum of the HQs over all the scenarios is less than 0.05, significantly less that the 0.25 screening comparison level.

In summary, the estimated air concentrations of chemicals potentially emitted from the training scenarios conducted at the Facility resulted in ELCR estimates well below EPA's benchmark value of 1 in 100,000, and noncancer HQs were below the screening level of 0.25. This comparison was true when considering each chemical individually and when combining all chemicals classified as carcinogens or noncarcinogens. With the conservative assumptions made throughout the risk assessment process and those specified in USEPA (1998a) guidance, no future risk is anticipated for any receptor locating near the Facility.

4.3.2 Acute Exposure Resulting from Direct Inhalation

In addition to long-term chronic effects, USEPA (1998a) guidance recommends that short-term or acute effects from direct inhalation of vapor phase and particle phase COCs be considered. The assumption is made that these short-term emissions will not have a significant impact through the indirect exposure pathways (as compared with the impact through long-term emissions). Therefore, the acute effects were evaluated through the short-term (maximum 1-hr) direct inhalation of vapors and particulates only.

The air concentrations used for the evaluation were determined using the ISCST3 and SCREEN3 models as described in Section 3. The maximum off-industrial property concentration (the most conservative value) was used for all six of the receptors evaluated.

To determine an acute hazard quotient (AHQ), it was necessary to identify acute inhalation exposure criteria (AIEC) values. USEPA (1998a) guidance recommends the following hierarchal approach in determining the AIEC value. Sources for determining the AIEC were reviewed in the following order:

- level 1 acute inhalation exposure guideline (AEGL-1),
- level 1 emergency response planning guidelines (ERPG-1),
- level 1 acute toxicity exposure levels (ATEL-1), and

- Department of Energy Temporary Emergency Exposure Limits (TEELs) and Subcommittee on Consequence Assessment and Protective Actions (SCAPA) toxicity.

Table 28 lists the AIEC values used in this assessment. If an AEGL value was present it was assigned as the AIEC value. If an AEGL value was not present but an ERPG value was, then it was used as the AIEC value. If neither an AEGL or ERPG could be located then an available ATEL or TEEL/SCAPA was used in the listed order.

Table 28 Acute Inhalation Exposure Criteria Values

Chemical	AEGL	ERPG	ATEL	TEEL/SCAPA
Antimony	NA	NA	NA	1.49E+00
Arsenic	NA	NA	NA	3.00E-02
Barium	NA	NA	NA	1.52E+00
Benzene	NA	1.60E+02	7.67E-01	1.60E+02
Benzo(a)pyrene	NA	NA	NA	1.00E+00
Beryllium	NA	NA	NA	9.95E-03
Cadmium	NA	NA	NA	2.99E-02
Chromium VI	NA	NA	NA	1.50E-01
Chrysene	NA	NA	NA	2.99E-01
Dibenz[a,h]anthracene	NA	NA	NA	3.01E+01
Ethylbenzene	NA	NA	NA	5.43E+02
Lead	NA	NA	NA	3.81E-02
Methylene Chloride	NA	6.95E+02	8.16E+01	6.95E+02
Naphthalene	NA	NA	NA	7.86E+01
Nickel	NA	NA	1.56E-03	3.00E+00
Phenol	NA	3.85E+01	NA	3.85E+01
Selenium	NA	NA	2.94E-03	5.81E-01
Silver	NA	NA	NA	3.00E-01
Styrene	NA	3.12E+02	2.16E+01	2.13E+02
Toluene	NA	1.88E+02	3.66E+01	1.88E+02
Vinyl Acetate	NA	1.76E+01	NA	1.76E+01

NA - Not Available

Equation 62 calculated the total hourly air concentration of a COC based on the fraction in vapor phase and in particle phase.

$$C_{acute} = Q \cdot [F_v \cdot Chv + (1 - F_v) \cdot Chp \qquad (62)$$

In equation 62, Q (g/s) is the COC-specific emission rate, F_v (unitless) is the fraction of the COC in vapor phase (Table 20), and Chv and Chp (μg·s/g·m^3) are the air modeling parameters for the vapor and particulate phase respectively.

The hourly air concentration (C_{acute}) and the determined AIEC value were then used to calculate an AHQ using Equation 63.

$$AHQ_{inh} = \frac{C_{acute} \cdot 0.001}{AIEC} \qquad (63)$$

The AHQ values were compared to see if they exceeded the recommended target level of 1.0 (USEPA 1998a).

The results of the acute comparisons for the ARFF, propane system, and drill tower scenarios are presented in Tables 54a, 54b, and 54c of the Appendix, respectively. None of the compounds considered in the acute assessment for either of the scenarios resulted in an AHQ greater than 1.0. In fact, the largest reported AHQ was 0.00059 for nickel for the industrial worker receptor in the ARFF scenario. Even if a receptor was assumed to be exposed to all three scenarios simultaneously, the resulting AHQ would be well below the target level of 1.0.

4.3.3 Special Considerations

4.3.3.1 Characterization of Potential Lead Exposure. Health issues related to lead exposure, in particular lead in soil as it pertains to children, are of concern to the general public. Therefore, the potential impact of lead exposure was assessed as described in the USEPA guidance (1998a, 1994a). The potential for lead toxicity from direct inhalation or from ingestion of soil is not assessed using the conventional equations that use an RfC or an RfD. Rather, a biokinetic model for children has been used to determine the health-protective concentration of lead in air or soil (USEPA 1998a). Direct exposure (inhalation) to a child was assessed by comparing the estimated air concentration to the health-protective air concentration of 0.2 $\mu g/m^3$ (USEPA 1998a). Indirect exposure (ingestion of soil) was assessed by comparing the estimated concentrations in soil to a maximum concentration in soil of 100 mg/kg. These are defined by the biokinetic model as the predictive concentration in air or soil that is expected to result in blood concentrations of less than 10 $\mu g/dl$ in children so exposed.

The predicted lead air concentrations (in $\mu g/m^3$) from the ARFF, propane system, and drill tower scenarios was 7.3×10^{-7}, 2.3×10^{-7}, and 4.7×10^{-7}, respectively. The total for all three scenarios, 1.4×10^{-6} $\mu g/m^3$, is approximately five orders of magnitude lower than the health-based level of 0.2 $\mu g/m^3$.

Soil concentrations of 3.5×10^{-5} mg/kg, 2.4×10^{-6} mg/kg, and 3.1×10^{-4} mg/kg were predicted for the ARFF, propane system, and drill tower scenarios, respectively. The sum of all three scenarios, 3.5×10^{-4} mg/kg, is also approximately five orders of magnitude lower than the target soil concentration of 100 mg/kg. Based upon these results, no impact from exposure to lead is expected in current actual or potential future populations surrounding the Facility.

4.3.3.2 Characterization of Potential Mercury Exposure. Mercury was listed in the USEPA Utility Report (USEPA 1998b) for fuel oil and natural gas as well as in Jenkins *et al.* (1996) used to estimate the emissions from burning hay. However, it was not considered in the USEPA (1990a) study used to estimate the emissions from burning wood. Evaluation of the most relevant pathway for mercury exposure, i.e. ingestion of fish containing methyl mercury, is a complex process. According to the USEPA Guidance (1998a), approximately 50% of mercury emissions are to be assumed to be deposited on the soil or surface water, with the remaining mercury entering the global cycle. Of the 50% deposited on the soil or surface water, a conservative estimate of 15% is to be assumed to be converted to methylmercury.

Using the estimated emissions listed in Tables 4 and 9 and the "Selected" Creek as the fishing source, the estimated HQ levels of 0.0039, < 0.00001, and 0.871 were determined for the ARFF, propane system, and drill tower scenarios, respectively. The HQ level for the drill tower was estimated using the subsistence fisher consumption rate of 0.00117 kg/kg-day. Although the calculated noncarcinogenic hazard for a subsistence fisher scenario for the drill tower scenario exceeded the screening benchmark level of 0.25, it did not exceed the USEPA standard of 1.0. This estimate is highly conservative and likely to be a significant overestimate for the following reasons.

- The waterbody selected, the "Selected" Creek, is unlikely to provide a supply of fish that would result in a recreational fish consumption rate of 0.0008 kg/kg-day must less a subsistence fisher consumption rate of 0.00117 kg/kg-day. This waterbody was selected due to its proximity to the Facility and its watershed being in the predominant downwind direction from the Facility. Any other waterbody selected in the area would have less exposure than this waterbody.

- The emission factors used in estimating the emission rate for mercury varied significantly with one emission factor reported as 0.0806 mg/kg of fuel burned and the other at 0.1971 mg/kg of fuel burned.

- More importantly, the methodology specified in USEPA (1998a) is highly conservative. Less conservative and more realistic assumptions regarding mercury fate and transport, than that specified in USEPA (1998a) would result in a significantly reduced estimate of the methylmercury content in fish, and consequently, a significantly reduced HQ.

4.4 Characterization of Uncertainties

Estimation of risks to human health that may result from exposure to chemicals in the environment is a complex process that often requires the combined efforts of multiple disciplines. In each step of a HHRA, from the toxicity assessment, exposure assessment, and risk characterization, parameter values are used and assumptions are made that are intended to be protective of human health and to ensure that estimates of risk are not underestimated. However, many of these parameter values and assumptions, whether regarding the toxicity value to use for a particular chemical or the value of a parameter in an exposure equation, have a degree of variability and uncertainty associated with them. The following section is intended to provide a discussion of the key uncertainties that could have an impact on the final estimates of the HHRA.

4.4.1 Uncertainties Related to Selection of Chemicals

4.4.1.1 Inclusion of Chemicals from the USEPA Utilities Report.

Because multimedia risk assessments are not required for firefighter training facilities, no actual emission data for chemicals potentially emitted during the training scenarios were available. Emission data for this risk assessment were therefore based on emission estimates published in literature that are representative of the potential emissions from these training scenarios. As discussed in Section 2.1, a literature search for emission estimates from the burning of diesel and gasoline produced extensive results for emissions from car exhaust but nothing for an open burn scenario. Literature searches for emission estimates for kerosene and aviation fuel from an open burn were conduced but no data were located.

Data that more accurately represented the conditions of the ARFF scenario were in the USEPA Utilities Report (USEPA 1998b), which defined expected emissions from the burning of No. 6 fuel oil (diesel) in an oil-fired boiler. Because aviation and kerosene are removed from the same fraction as diesel, it is expected that their constituents would be similar to diesel. Therefore, the emission factors from USEPA (1998b) were used as surrogates for kerosene and aviation fuel. As discussed above, the only emission factors that could be located for gasoline were from car exhaust, with no data available for open burning or using gasoline as fuel in a boiler. Since gasoline is a more refined petroleum product than diesel, it is expected to contain fewer impurities. Therefore, it is anticipated that the emissions from gasoline would contain smaller amounts of metals and semi-volatile compounds than diesel but contain higher concentration of certain volatile compounds. Therefore, the diesel emission factors from USEPA (1998b) were used as surrogates for gasoline. For the ARFF training scenario, burning diesel, gasoline, aviation fuel, and kerosene, and for the propane system training scenario, burning propane, surrogate data for metals in No. 6 fuel and natural gas and for organic chemicals potentially present in No. 6 fuel oil and natural gas, including dioxin and furan congeners, as listed in the USEPA Utilities Report (USEPA 1998b) were selected.

Use of surrogate data from the USEPA Utilities Report (USEPA 1998b) introduces some uncertainty into the emissions estimates that are likely to result in an overestimate/underestimate of these emissions. The emissions from USEPA (1998b) are based upon the burning of fuel oil or natural gas in a boiler in which some control of oxygen levels and temperature can be maintained. At the Facility, the diesel and propane will be burned without controls, which will have an effect on the amount of CO produced. As stated in USEPA (1995a) for residential fireplaces, because of inefficient combustion, low combustion temperatures, and large amounts of excess air, a higher ratio of CO to CO_2 is produced than in a wood-fired boiler. Though it was not stated, one could assume that a similar ratio would apply between CO to CO_2 for an open burn of diesel and a diesel-fired boiler and that a larger emission rate for CO for the ARFF scenario may result.

In a boiler unit, the temperature is high enough that secondary combustion (combustion away from the flame source) occurs resulting in the destruction of additional volatile compounds. Because the combustion temperature at the Facility is less than that maintained in the boiler unit, it is likely that a larger concentration of VOCs would be released at the Facility than released from the boiler unit. However, any increase would contribute very little to the overall estimate of direct inhalation or indirect risk since the VOCs are minor contributors.

However, in the case of inorganic compounds, it is likely that the predicted concentrations have been overestimated. For this analysis it was assumed that all of the metals measured in the fuel oil were emitted into the air. In fact, due to the lower burning temperature during training scenarios conducted at the Facility, it is more likely that the majority of metals would not be emitted into the atmosphere, but rather would be contained within the ash. Since the metals contribute more to the risk than VOCs, the risk estimates for the Facility are potentially overestimated.

In addition, all of the organic chemicals listed on the composite list in the USEPA Utilities Report as being present in one or more fuel oil- or natural gas-fired plants were assumed to be emitted during training scenarios at the Facility. However, not all chemicals on this composite list were detected in stack emissions for each fuel oil- or gas-fired facility surveyed by the USEPA. Consequently, it is unlikely that organic chemical emissions from this Facility were underestimated.

4.4.1.2 Consideration of PCDD/PCDF Congeners. As indicated in Section 2.1, PCDD/PCDF congeners were reported in the USEPA Utilities Report (1998b). Dioxins and furans require a fuel source that has both available chlorine source (i.e. hydrogen chloride) and preferably, a ring structure source (i.e., benzene), both of which would be present in diesel in some quantity. During combustion, thermal breakdown of trace metals, chlorinated compounds, and organic materials takes place. As the gas flue leaves the primary combustion chamber, these compounds cool from 1000 degrees C and subsequently condense. It is during this molecular rearrangement that dioxins are formed. The formation of dioxin commonly occurs in the range between 650 to 300 degrees C, with maximum formation occurring at approximately 300 degrees. For an open burn as proposed for the ARFF training scenario, it is doubtful that temperatures would reach this magnitude. While it is unlikely that the PCDD/PCDF congeners are formed during the ARFF training scenario to the same extent they are formed in a utility boiler, as a conservative response the estimated presented in USEPA (1998b) were used for the analysis.

In this assessment, it was assumed that all the 2,3,7,8-PCDD/PCDF congeners reported in the composite list in the USEPA Utilities Report were present in potential emissions for the ARFF training scenario at concentrations estimated using MEFs given in the USEPA Utilities Report. As stated, not every congener in the composite list was found in stack emissions at every facility evaluated by the USEPA. By assuming that all dioxin/furan congeners in the composite list could be released at the Facility, it is unlikely that these emissions are underestimated.

Since dioxins and furans are contaminants in air emissions of most combustion sources, including forest fires, they would be expected to form during the combustion of hay and wood. However, their concentration in these emissions is expected to be minuscule. Dioxin and furan congeners were not evaluated in either Jenkins *et al.* (1996) or in USEPA (1990b) and were not included in the assessment of emissions for the drill tower training scenario.

4.4.1.3 Use of Wheat Straw as a Surrogate for Hay. As discussed in Section 2.3.1, emission factors used to estimate potential emissions of VOCs, PAHs, and inorganics due to the burning of hay were obtained from Jenkins *et al.* (1996). This study evaluated the potential emissions produced from the burning of a number of agricultural and forest products, including rice straw, wheat straw, barley straw, corn stover, and prunings of certain trees. Because the source material for the hay used during the drill tower training scenario was unknown, a surrogate value had to be selected. For this assessment, wheat straw was selected as a surrogate for the hay because it produced more total PAHs and contained larger concentrations of the metals, cadmium, and nickel, which can be major contributors to carcinogenic risk, and mercury, a major contributor to noncarcinogenic risk.

Table 29 presents the average results for the VOCs and PAHs measured for wheat straw, barley straw, rice straw, and corn stover and a percentage comparison of the differences in the values for barley straw, rice straw, and corn stover with the wheat straw. Barley straw, rice straw, or corn stover had detects for additional VOCS which either were not detected or not looked for in the wheat straw analysis. These VOCs were acetone, butane, dimethyloxirane, pentene, dimethylbutane, hexane, dimethylfuran, 2-methyl 2-cyclopenten-1-one, 2-chloro phenol, benzonitrile, and trimethylpentane. These compounds either have not been evaluated or are not listed as a human carcinogen and would not have been addressed in the carcinogenic risk assessment. A few of the compounds had larger emission factors for either barley straw, rice straw, or corn stover; however, these compounds are only assessed in the noncarcinogenic pathway and, with the exception of phenol and styrene, their differences are insignificant.

As indicated in Table 29, only a few of the PAH emission factors for rice straw are larger than the emission factors for the same PAHs for wheat straw. This being the case, it is expected that the estimated risk calculated using the wheat straw emission factors would be larger than those for the rice straw. All of the PAH emission factors for barley are larger than the corresponding emission factor for wheat straw, with the exception of naphthalene, fluoranthene, benz[a]anthracene, perylene, and indeno[1,2,3-cd]pyrene. Estimates of ELCRs were generated using the barley straw resulting in an increase in risk by a factor of 1.2 in both the direct inhalation pathway and the indirect pathways. Corn

Table 29 Comparison of Emission Factors for Organic Compounds from Rice Straw, Barley Straw, and Corn Stover with Wheat Straw

	Average				% Comparison with Wheat Straw		
Compound	Rice Straw	Wheat Straw	Barley Straw	Corn Stover	Rice Straw	Barley Straw	Corn Stover
Volatile Organic Compounds (mg/kg)							
Acetone				68			-
Butane	11				-		
Dimethyloxirane	6				-		
Pentene	208				-		
Benzene	75	145	149	35	51.7%	102.8%	24.1%
Dimethylbutane	45				-		
Hexane			177			-	
Phenol	127	48		36	264.6%	0.0%	75.0%
Dimethylfuran	173		52	81	-	-	-
2-methyl 2-cyclopentenone				22			-
2-chloro phenol				29			-
Toluene	77	52	82	46	148.1%	157.7%	88.5%
Benzonitrile	2				-		
Benzaldehyde	35	35	36	26	100.0%	102.9%	74.3%
Styrene	55	91	652	16	60.4%	716.5%	17.6%
Xylene	16	26	18		61.5%	69.2%	0.0%
Trimethylpentane			72			-	
Benzofuran	2	13	13		15.4%	100.0%	0.0%
Naphthalene	15	51	23	10	29.4%	45.1%	19.6%
Total	847	461	1274	369	183.7%	276.4%	80.0%
Polycyclic Aromatic Hydrocarbons (μg/kg)							
Naphthalene	8385	196192	80297	4481	4.3%	40.9%	2.3%
2-Methylnaphthalene	5427	1074	2697	2626	505.3%	251.1%	244.5%
Acenaphthylene	1058	1504	11747	402	70.3%	781.1%	26.7%
Acenaphthene	306	170	9313	660	180.0%	5478.2%	388.2%
Fluorene	363	318	2702	121	114.2%	849.7%	38.1%
phenanthrene	1541	4093	17346	1606	37.6%	423.8%	39.2%
Anthracene	271	1073	3000	189	25.3%	279.6%	17.6%
Fluoranthene	451	3929	2302	801	11.5%	58.6%	20.4%
Pyrene	347	2471	3577	766	14.0%	144.8%	31.0%
Benz[a]anthracene	145	1302	1130	192	11.1%	86.8%	14.7%
Chrysene	173	1369	1425	274	12.6%	104.1%	20.0%
Benzo[b]fluoranthene	147	1135	2404	4664	13.0%	211.8%	410.9%
Benzo[k]fluoranthene	96	481	599	2853	20.0%	124.5%	593.1%
Benzo[a]pyrene	77	408	781	9561	18.9%	191.4%	2343.4%
Benzo[e]pyrene	108	592	1008	11258	18.2%	170.3%	1901.7%

Table 29 (continued)

Compound	Average				% Comparison with Wheat Straw		
	Rice Straw	Wheat Straw	Barley Straw	Corn Stover	Rice Straw	Barley Straw	Corn Stover
Perylene	19	438	231	2081	4.3%	52.7%	475.1%
Benzo[ghi]perylene	38	1046	522	567	3.6%	49.9%	54.2%
Indeno[1,2,3-cd]pyrene	62	673	592	9672	9.2%	88.0%	1437.1%
Dibenz[a,h]anthracene	-	-	10	565			
Total	19013	218268	141683	53339	8.7%	64.9%	24.4%

stover was not evaluated as a likely surrogate for the hay to be used in the training scenario because it would not be as readily available as wheat straw.

Table 30 presents the average results for the inorganics measured for wheat straw, barley straw, rice straw, and corn stover and a percentage comparison of the differences in the values for barley straw, rice straw, and corn stover with the wheat straw. For barley straw the only metals kept in the analysis which exceeded those values reported for wheat straw were chromium, manganese, and antimony. Using the emission factors reported for barley straw these three metals would have little effect on the overall risk. Metals which have lower emission factors for barley straw than for wheat straw were chlorine, nickel, zinc, silver, cadmium, barium, mercury, and arsenic and selenium (which were not detected in barley straw). The use of these emission factors would reduce the risk or HQ to a greater extent than the increase that would occur from the three metals that had a larger emission factor in barley straw.

Corn stover values for chromium, manganese, zinc, arsenic, and selenium all exceeded those of wheat straw by less than a factor of two. Chlorine, nickel, silver, cadmium, antimony, barium, and mercury had lower emission factors for corn stover than

Table 30 Comparison of Emission Factors for Inorganic Compounds from Rice Straw, Barley Straw, and Corn Stover with Wheat Straw

Compound	Average (mg/kg)				Percent Comparison with Wheat Straw		
	Rice Straw	Wheat Straw	Barley Straw	Corn Stover	Rice Straw	Barley Straw	Corn Stover
Aluminum	0.227	10.3	9.27	3.88	2.2%	89.8%	37.6%
Silicon	89.7	20.9	13.9	9.09	428.9%	66.5%	43.5%
Phosphorus	0	3.54	3.44	0.562	-	97.2%	15.9%
Sulfur	36.5	102	336	28.8	35.7%	328.8%	28.2%
Chlorine	849	973	373	942	87.2%	38.3%	96.8%
Potassium	544	894	1298	558	60.8%	145.1%	62.3%
Calcium	16.7	3.87	8.02	6.29	432.7%	207.3%	162.7%
Titanium	0.493	0.399	0.201	0.181	123.8%	50.5%	45.4%
Vanadium	0.044	0.138	0.004	0.040	32.1%	2.7%	29.1%
Chromium	0.103	0.080	0.139	0.095	128.5%	173.1%	118.6%
Manganese	4.77	0.240	0.304	0.358	1982.1%	126.6%	148.9%
Iron	5.91	5.32	2.46	2.82	111.2%	46.2%	53.1%
Cobalt	0.016	0.018	0.019	0.008	87.9%	104.8%	42.8%
Nickel	0.046	0.052	0.011	0.034	88.4%	21.4%	65.5%
Copper	0.234	0.073	0	0.048	322.0%	-	65.4%
Zinc	0.940	0.563	0.492	0.766	166.9%	87.4%	136.0%
Gallium	0.012	0.029	0	0	40.9%	-	-
Arsenic	0.092	0.006	0	0.011	1451.2%	-	170.1%
Selenium	0.049	0.020	0	0.025	241.3%	-	122.1%
Bromine	5.03	4.02	8.43	3.03	125.0%	209.6%	75.3%
Rubidium	0.578	0.311	0.417	0.213	185.7%	134.0%	68.5%
Strontium	0.119	0.069	0.120	0.088	172.5%	174.9%	128.2%
Yttrium	0.033	0.051	0.025	0.016	64.3%	49.9%	32.2%
Zirconium	0.043	0.015	0	0.006	296.1%	-	42.5%
Molybdenum	0.040	0.097	0.048	0.010	40.9%	49.5%	10.4%
Palladium	0.030	0.401	0	0.079	7.6%	-	19.6%
Silver	0.145	0.523	0.284	0.205	27.6%	54.2%	39.1%
Cadmium	0.075	0.875	0.240	0.000	8.5%	27.4%	-
Indium	0.036	0.137	0.333	0	26.4%	243.5%	-
Tin	0.142	0.267	0.059	0.010	53.1%	22.1%	3.9%
Antimony	0.099	0.282	0.659	0.054	35.2%	233.8%	19.1%
Barium	0.816	0.934	0.290	0.477	87.3%	31.1%	51.0%
Lanthanum	0.415	0.703	0	0.270	59.1%	-	38.4%
Gold	0.022	0.128	0.011	0.000	16.9%	8.7%	-
Mercury	0.034	0.139	0.096	0.027	24.8%	69.2%	19.3%
Thallium	0.031	0	0	0	-	-	-
Lead	0.061	0.108	0	0	56.6%	-	-
Uranium	0.119	0.008	0.004	0.008	1573.7%	49.0%	100.0%

for wheat straw. As with the comparison of wheat straw and barley straw these differences would result in a change of risk by no more than a factor of two and no less than a factor of one-half. Metals for rice straw which had greater emission factors than for wheat straw were chromium, manganese, zinc, arsenic, and selenium. Of these arsenic was the most significant having an increased emission factor of 15 times that of wheat straw. This would result in only a small increase in risk since arsenic does not contribute significantly to the risk assessment. The emission factors for rice straw for the metals chlorine, nickel, silver, cadmium, antimony, barium, and mercury were lower than the emission factors reported for wheat straw. The mercury emission factor for rice straw was approximately one-quarter the emission factor for wheat straw.

Overall, the selection of barley straw, rice straw, or corn stover as the surrogate for hay instead of wheat straw would have little effect on the overall risk. From a review of the comparisons of each one's emission factor with that of wheat straw, the risk using any of the material would be between a factor of one-half to double the reported risk. Even if the risk were doubled it would still be less than the USEPA benchmark level of 1 in a 100,000 for carcinogenic risk. The HQ for the two non-carcinogens, chlorine and mercury, reported above the 0.25 comparison level would be reduced since barley straw, rice straw, and corn stover all reported emission factors less than wheat straw.

4.4.2 Uncertainties Related to Estimated Emissions

Since the Facility has yet to be constructed and any training scenarios performed, many assumptions had to be made in the air modeling regarding the source of the emissions. The selection of the air modeling receptor node(s) used to represent the concentration and deposition values for the subsistence farmer, subsistence fisher, adult residence, and the child receptors is a very subjective portion of the risk assessment. Different individuals performing an assessment could make different assumptions as to where the most appropriate location for these receptors occurs. In the assessment, all six receptors were located at a hypothetical location that corresponded to the point of maximum off-site concentration and deposition. While the maximum off-site concentration and maximum off-site deposition may have occurred at separate physical locations, for this assessment it was assumed they were co-located, thus maximizing the exposure to the receptor. The selection of any other suitable location in the area surrounding the Facility would result in lower concentrations and, therefore, lower estimates of ELCR. Use of the air modeling results at an actual receptor node, i.e., use of the air concentrations and dry deposition values estimated at the receptor node for the maximum wet deposition, and conversely use of the wet deposition value estimated at the point of maximum air concentrations would result in lower estimates of risk.

As indicated in Section 3.6.2.3, the assumption was made that the materials in the drill tower scenario are being burned inside an enclosed structure and that the emissions escape through the windows of the structure. This assumption results in less plume rise than if it were assumed that the material was being burned in the open. With a smaller plume rise, the concentration of pollutants do not have as much time to disperse and therefore are deposited closer to the drill tower. A smaller plume rise results in estimated deposition values closer to the Facility that are larger than if a higher plume rise had been assumed.

Additionally, since the drill tower has not been constructed, no accurate dimension of the tower were available. Dimensions for the tower were selected from a schematic, located on the Internet, of another drill tower used for firefighter training (High Country Training Center 2000). Use of the actual dimensions of the drill tower to be constructed would probably have negligible effect.

4.4.3 Uncertainties Related to Selection of Receptors and Pathways

4.4.3.1 Receptors Considered in the Assessment. No resident currently lives at the location selected in the risk assessment. If an actual existing resident had been selected in the analysis, any risk associated from the emissions at the Facility would have been negligible. However, to provide a conservative estimate as to the risk to an individual who might live near the Facility in the future, the maximum off-site concentration and deposition location was selected.

Six hypothetical receptors were evaluated according to the USEPA guidance (1998a) as those with the greatest potential for exposure if such individuals were present in the future. As stated, all receptors were assumed to be at the point of maximum air concentration and wet and dry particle deposition outside of the fence line. For these receptors, it was assumed that the maximum off-site vapor and dry deposition location was co-located with the maximum off-site wet deposition location. Placing the receptor at an existing residential location would result in lower estimates of risk.

4.4.3.2 Waterbody Considered in the Assessment. Although no waterbodies in the area are suitable to sustain a subsistence fisher, the "Selected" Creek was selected as the waterbody to be used in the assessment. While other waterbodies, such as Little Colvin Creek, Colvin Creek, Sixteen Branch, Beach Branch, or Cypress Creek could have been chosen, the "Selected" Creek was selected due to its proximity to Facility and location in the downwind path of the emissions. It is, therefore, likely that the "Selected" Creek would receive the majority of the deposition from the Facility emissions and estimated surface water concentrations and fish concentrations should be higher for it than for other waterbodies in the area.

Additionally, the "Selected" Creek was used to estimate the risk associated with the use of surface water as a drinking water source. While this waterbody is not capable of being used as a drinking water source, it provides an upper bound on the risk associated with the consumption of drinking water. Any other waterbody in the Facility area, which could be used as a drinking water source, would be expected result in a smaller estimate of extra risk than that associated with the usage of the "Selected" Creek as a drinking water source.

4.4.4 Summary of the Uncertainty Assessment

While not an exhaustive list of uncertainties, the above discussion has focused on those aspects of the analysis that could result in an increase or decrease in estimated risks. However, none of these changed the estimated risks significantly, and all risks remained below the benchmark levels of 1×10^{-5} for cancer risk and 1.0 for noncancer HIs, as per the USEPA Guidance.

This assessment relied on health protective assumptions and values for default parameters that were selected to minimize the likelihood that any risk was underestimated. The application of additional site-specific data, such as the actual locations and activities of potential receptors; actual, rather than estimated emissions data; or chemical-specific data, such as soil degradation of organic chemicals or the bioavailability of ingested chemicals, would result in estimates of risk that are significantly lower than those reported in this analysis.

4.5 Summary of Human Health Risk Assessment

This multimedia risk assessment was conducted using USEPA methodology and parameter values (USEPA 1998a). These methods are intended to provide conservative upper bound estimates of chemical concentrations in various media, and consequently, upper bound estimates of chemical intake and lifetime cancer risk.

The estimated ELCR was less than 1 in a 100,000 for all of the hypothetical receptors evaluated when all pathways applicable to each receptor were considered. For this assessment the potential receptor was placed at the point of maximum wet deposition, maximum dry deposition, and maximum vapor concentration off Facility property. This location was approximately 300 m north of the drill tower. Additionally, the site visit indicated that less than 1000 residents live within 3-km of the Facility. Consequently, due to both the methodology employed and the location of the hypothetical receptor, it is likely that these estimates of ELCR are considerably overstated. According to this analysis, emissions from the training scenarios conducted at the Facility are unlikely to result in an adverse impact to persons currently living in the vicinity of the Facility or who may reside or work in the area in the future.

5.0 PRIORITY POLLUTANTS

Priority pollutants – PM, SO_x, NO_x, and CO – do not have standard toxicity values, such as a CSF or an RfD. Rather, these chemicals have promulgated ambient air standards that cannot be exceeded. The relevant ambient air standards for these compounds are listed in Table 31. These compounds were evaluated only for the direct inhalation pathway.

Table 31. National Ambient Air Quality Standards

Priority Pollutant	NAAQS Comparison Standard ($\mu g/m^3$)	Annual NAAQS Comparison Standard ($\mu g/m^3$)
Particulate Matter	150 24-hr	50
Carbon Monoxide	40,000 1-hr	NA
Sulfur Oxides	1300 3-hr	80
Nitrogen Oxides	100 Annual	100

NA - Not applicable

Estimated emission factors for priority pollutants have been previously discussed in Section 2. These estimated emission factors, along with parameter values derived using the air modeling (Section 3), were used to estimate the concentration of each priority pollutant in $\mu g/m^3$. This air concentration was assessed at the off-site location with the highest estimated concentrations. The estimated concentrations for each priority pollutant were then compared with their respective NAAQS (USEPA 1990). A discussion of the results of that comparison for each training scenario at the Facility follows.

5.1 Priority Pollutant Emissions Estimated for the ARFF Scenario

The estimated emissions for priority pollutants from the burning of diesel, gasoline, aviation fuel, and kerosene to simulate an aircraft fire are shown in Table 32. As indicated in Section 2.1, it is assumed that all the compounds are similar to diesel. An hourly emission estimate, which assumed that all 200 gal of fuel were burned within an hour, and an annual average emission rate were determined for each of the priority pollutants. The emission factor, in units of lb of pollutant produced per 1000 gal of fuel burned, was obtained from the AP-42 document (USEPA 1995a) for the burning of diesel in a utility boiler. To obtain the hourly value, the emission factor was multiplied by 200 gal of fuel used, with the result converted to g/s. An air concentration for each of the priority pollutants was obtained by multiplying the emission estimate in g/s times the unitized hourly air concentration in $\mu g{\cdot}s/gm{\cdot}m^3$ determined during the air modeling. This resulted in an air concentration in $\mu g/m^3$, which was compared with the applicable NAAQS standard (USEPA 1990). The results from this comparison indicate that all priority pollutants are well below the NAAQS (Table 33).

Average annual emission rates of priority pollutants were determined by assuming that 48,000 gal of fuel oil would be burned per year. A comparison of the estimated concentrations for each priority pollutant with its respective NAAQS annual standard is presented in Table 34 and indicated that the emission rates were significantly less than the NAAQS standards.

Table 32 Priority Pollutant Emission Rates

		Emission Factor	Hourly Emission Rate			Annual Emission Rate		
Device	Pollutant	lb/ton	lb/hr[a]	gm/sec	($\mu g/m^3$)[b]	lb/yr[a]	gm/sec	($\mu g/m^3$)[b]
Wood	PM-10	34.6	1.73	0.2180	94.04	1245.6	0.0179	0.0191
	CO	252.6	12.63	1.5914	686.5	9093.6	0.1307	0.1397
	So_x	0.4	0.02	0.0025	1.09	14.4	0.0002	0.0002
	No_x	2.6	0.13	0.0164	7.07	93.6	0.0013	0.0014
Hay	PM-10	9.72	2.43	0.3062	132.1	1749.6	0.0251	0.0269
	CO	102.4	25.6	3.2256	1391.5	18432.0	0.2649	0.2831
	So_x	1.09	0.2725	0.0343	14.81	196.2	0.0028	0.0030
	No_x	5.08	1.27	0.1600	69.03	914.4	0.0131	0.0140
		lb/1000 gal	lb/hr[a]	gm/sec	($\mu g/m^3$)[b]	lb/hr[a]	gm/sec	($\mu g/m^3$)[b]
Propane	PM-10	0.40	0.0009	0.0001	0.083	2.8	0.00004	0.0001
	CO	1.90	0.0045	0.0006	0.394	13.5	0.0002	0.0006
	So_x	0.10	0.0002	0.0000	0.020	0.7	0.0000	0.0000
	No_x	14.00	0.0330	0.0042	2.899	99.1	0.0014	0.0047
Fuel Oil	PM-10	10.00	2.0000	0.2520	15.145	480.0	0.0069	0.0006
	CO	5.00	1.0000	0.1260	7.573	240.0	0.0034	0.0003
	So_x	159.00	31.8000	4.0068	240.801	7632.0	0.1097	0.0100
	No_x	55.00	11.0000	1.3860	83.300	2640.0	0.0379	0.0035

[a] - Obtained by multiplying the Emission Factor by the amount of fuel consumed over an hour and annually.

[b] - Obtained by multiplying the hourly emission rate by the unitized air concentration estimated during the air modeling.

Table 33. Summary of Maximum One-hour Concentrations on Priority Pollutants

Priority Pollutant	Maximum One-hour Concentration ($\mu g/m^3$)				NAAQS Comparison Standard ($\mu g/m^3$)
	ARFF	Propane System	Drill Tower	Combined	
Particulate Matter	15.15	0.1	226.1	241.3	150 24-hr
Carbon Monoxide	7.6	0.4	2078.0	2086.0	40,000 1-hr
Sulfur Oxides	240.8	0.02	15.9	256.7	1300 3-hr
Nitrogen Oxides	83.3	2.9	76.1	162.3	100 Annual

Table 34. Summary of Annual Concentrations on Priority Pollutants

Priority Pollutant	Annual Concentration ($\mu g/m^3$)				NAAQS Comparison Standard ($\mu g/m^3$)
	ARFF	Propane System	Drill Tower	Combined	
Particulate Matter	0.0006	0.0001	0.0482	0.0489	50 Annual
Carbon Monoxide	0.0003	0.0006	0.4426	0.4436	NA
Sulfur Oxides	0.0100	0.00003	0.0034	0.0134	80 Annual
Nitrogen Oxides	0.0035	0.0047	0.0162	0.0244	100 Annual

NA - Not Applicable

5.2 Priority Pollutant Emission Estimated for the Propane System Scenario

The estimated emissions for priority pollutants from the burning of propane during the propane system scenario are shown in Table 32. An hourly emission estimate, which assumed that 45 lb of propane were burned within an hour (25 events per day or approximately 3 per hour), and an annual average emission rate were determined for each of the priority pollutants. The emission factor in units of lb of pollutant produced per 1000 gal of fuel burned was obtained from the AP-42 document (USEPA 1995a) for the burning of propane in a utility boiler. To obtain the hourly value, the emission factor was multiplied by 45 lb of fuel (converted to gal by dividing by 8.2 lb/gal and the specific gravity of 1.55) used, with the result converted to g/s. An air concentration for each of the priority pollutants was obtained by multiplying the emission estimate in g/s times the unitized hourly air concentration in $\mu g \cdot s/gm \cdot m^3$ determined during the air modeling. This resulted in an air concentration in $\mu g/m^3$ which was compared with the applicable NAAQS standard. The results from this comparison indicate that all priority pollutants are well below the NAAQS (Table 33).

Average annual emission rates of priority pollutants were determined by assuming that 90,000 lb of propane would be burned per year. A comparison of the estimated concentrations for each priority pollutant with its respective NAAQS annual standard is presented in Table 34 and indicated that the emission rates were significantly less than the NAAQS standards.

5.3 Priority Pollutant Emissions Estimated for the Drill Tower Scenario

The estimated emissions for priority pollutants from the burning of hay and wood during the drill tower scenario are shown in Table 32. An hourly emission estimate, which assumed that 100 lb of wood and 500 lb of hay were burned within an hour, and an annual average emission rate were determined for each of the priority pollutants. While 15 lb of propane will be used during each event, in comparison with the hay and wood the emissions resulting from the use of propane were deemed insignificant and were not included in the drill tower scenario. The emission factor in units of lb of pollutant produced per ton of wood/hay burned was obtained from the AP-42 document (USEPA 1995a) for wood and from Jenkins *et al.* (1996) for hay. To obtain the hourly value, the emission factor was multiplied by 100 lb wood or 500 lb of hay used, with the result converted to g/s. An air concentration for each of the priority pollutants was obtained by multiplying the emission estimate in g/s times the unitized hourly air concentration in $\mu g \cdot s/gm \cdot m^3$ determined during the air modeling. This calculation resulted in an air concentration in $\mu g/m^3$ which was compared with the applicable NAAQS standard (Table 33).

As shown in Table 33, values for CO, SO_x, and NO_x are less than the listed NAAQS standards. The calculated PM maximum 1-hr value of 226.1 $\mu g/m^3$ (94 $\mu g/m^3$ from wood and 132.1 $\mu g/m^3$ from hay) is larger than the NAAQS 24-hour standard of 150 $\mu g/m^3$. The 24-hr standard indicates that over a 24-hr period, the average hourly concentration can not exceed 150 $\mu g/m^3$. Put another way, while during 1-hr the 150 $\mu g/m^3$ could be exceeded by some amount (160 $\mu g/m^3$) sometime within the 24-hr period a 1-hr concentration would have to be less than 150 $\mu g/m^3$ by the same difference (140 $\mu g/m^3$) in order for the average to be 150 $\mu g/m^3$. Since the drill tower scenario is performed only three times per day (material is burned only 3 hrs/d), the airmodeling was performed to determine a maximum 24-hr average for PM. The calculated PM maximum 24-hr value was 11.28 $\mu g/m^3$ which is less than the 24-hr NAAQS standard of 150 $\mu g/m^3$.

Average annual emission rates of priority pollutants were determined by assuming that 360,000 lb of hay and 72,000 lb of wood would be burned per year. A comparison of the estimated concentrations for each priority pollutant with its respective NAAQS annual standard is presented in Table 34 and indicated that the emission rates were significantly less than the NAAQS standards.

5.4 Priority Pollutants Resulting from Combined Emissions

Sections 5.1, 5.2, and 5.3 addressed the effects of priority pollutants for the ARFF, propane system, and drill tower scenarios individually. This section assesses the overall impact of priority pollutants for all three scenarios combined. In the comparison of the hourly concentrations the conservative assumption is made that all three scenarios are being performed concurrently.

The comparison of the estimated maximum 1-hr priority pollutant concentrations is presented in Table 33. As shown in Table 33, values for CO and SO_x are less than the listed NAAQS standards. The calculated PM maximum 1-hr value of 241.3 $\mu g/m^3$ is larger than the NAAQS 24-hr standard of 150 $\mu g/m^3$. The 24-hour standard indicates that over a 24-hr period, the average hourly concentration can not exceed 150 $\mu g/m^3$. Put another way, while during 1-hr the 150 $\mu g/m^3$ could be exceeded by some amount (160 $\mu g/m^3$) sometime within the 24-hr period a 1-hr concentration would have to be less than 150 $\mu g/m^3$ by the same difference (140 $\mu g/m^3$) in order for the average to be 150 $\mu g/m^3$. Since the drill tower scenario is performed only three times per day (material is burned only 3 hrs/d) and the ARFF scenario once per day, air modeling was conducted to estimate the maximum 24-hr value for PM. The estimated value was 11.65 $\mu g/m^3$ which is less than the 24-hr NAAQS standard for PM of 150 $\mu g/m^3$. The combined NO_x maximum 1-hr value of 162.3 $\mu g/m^3$ is larger than the NAAQS annual standard of 100 $\mu g/m^3$. However, since the ARFF scenario is performed only once per day, the drill tower scenario is performed only three times per day, and assuming the propane system scenario's is performed over an eight hour period, when converted into an appropriate annual value the combined NO_x value would be less. This is indicated in Table 34 which compares the average annual values with their appropriate NAAQS standards.

A comparison of the estimated annual concentrations for each priority pollutant with its respective NAAQS annual standard is presented in Table 34 and indicated that the emission rates were significantly less than the NAAQS standards. In conclusion, these comparisons show that the primary pollutant emissions from the training scenarios at the Facility, either individually or combined, are well below the NAAQS.

The potentially more toxic $PM_{2.5}$ fraction is contained within the PM fraction. The ambient air concentration of PM resulting from Station emissions was estimated to be 0.05 $\mu g/m^3$. This concentration is well below the allowable concentration of 50 $\mu g/m^3$ listed for PM in the NAAQS. Because there are no promulgated standards for $PM_{2.5}$s, a direct comparison cannot be made. However, if it is assumed that all of the PM fraction emitted from the Station exists as $PM_{2.5}$, the standard for $PM_{2.5}$s would have to be more than two orders of magnitude lower than the existing standard for PM in order for potential $PM_{2.5}$ emissions to exceed an allowable level (50 $\mu g/m^3$ / 0.05 $\mu g/m^3$ = 1000 times lower).

6.0 SUMMARY OF HUMAN HEALTH AND PRIORITY POLLUTANTS

The construction of a Firefighter Training Facility ("Facility") has been proposed in Lincoln Parish near Ruston, Louisiana. At the time of this report, the exact plans and location of the proposed Facility was unknown, therefore a hypothetical facility and location were assumed. This report was prepared to provide some input into the potential human health impacts from the combustion of materials at a such a hypothetical firefighter training facility. Within the Facility, three areas, the airport rescue and firefighting (ARFF) area, the propane system area, and the drill tower area, are expected to be used to conduct "training" scenarios. During the course of these training exercises, various fuels (i.e., gasoline, wood) (Table 1) will be burned resulting in the release of both uncombusted fuel constitutes and other constituents formed during the combustion process (e.g., carbon monoxide). These materials may be transported in air to the surrounding areas where people living or working in the area or ecological receptors in the area may come in contact with these chemicals. Assessment of the air quality impact associated with the burning of materials used during training scenarios at the Facility included the following:

- an evaluation of the potential human health risks assessed using a multimedia, multipathway analyses and
- a comparison of the potential amount of priority pollutants, carbon monoxide, nitrogen oxides, sulfur oxides, and particular matter (PM), released during training exercises with their corresponding NAAQS (USEPA 1990a).

6.1 Human Health Risk Assessment

The methodology used for the HHRA was consistent with the guidance and recommendations of USEPA, as described in *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities* (USEPA 1998a) (USEPA Guidance). A brief summary of each step in the risk assessment follows.

> ***Hazard assessment***: identifying the chemicals that may be emitted during training scenarios and determining how much (emission rates) of each chemical of potential concern to public health is emitted;
>
> ***Dose-response toxicity assessment***: identifying the types of adverse health effects that could be associated with exposure, and the level at which a substance may cause an adverse impact by identifying the health standards/cancer potency factors that exist for each chemical of concern;
>
> ***Exposure assessment:*** determining who might be exposed (identifying receptors), how people might be exposed (relevant pathways) and the extent, frequency and duration of actual/potential exposures to chemicals; and
>
> ***Risk characterization***: evaluating (determining) the probability that an adverse health impact may occur as a result of exposure to chemicals in the amount and by pathways identified; evaluating the uncertainty in those estimates; and, finally, interpreting the estimated risks in terms of whether the training scenarios pose potential health impacts to area residents.

6.1.1 Hazard Assessment

It is anticipated that the Facility will generate emissions from several fuels, including diesel, gasoline, aviation fuel, kerosene, propane, wood, and hay. It is estimated that the Facility will burn 12,000 gal each of diesel, kerosene, gasoline, and aviation fuel per year during its ARFF scenarios. It is also anticipated that 90,000 lb of propane will be burned during the year in the propane system scenarios, while 72,000 lb of wood, 360,000 lb of hay, and 10,800 lb of propane will be burned per year in the drill tower scenarios.

While an extensive literature search was performed to determine potential emissions from the open burning of diesel, gasoline, aviation fuel, and kerosene, no data were located. Data located that most accurately represented the conditions of the ARFF scenario were reported in the USEPA Utilities Report (USEPA 1998b), which defined expected emissions from the burning of No. 6 fuel oil (diesel) in an oil-fired boiler. Because aviation fuel and kerosene are removed from the same fraction as diesel (Jones 2000), it is expected that their constituents would be similar to diesel and diesel was used as a surrogate. Since gasoline is a more refined petroleum product than diesel, it is expected to contain fewer impurities. Therefore, it is anticipated that the emissions from gasoline would contain smaller amounts of metals and semi-volatile compounds than diesel but contain higher concentration of certain volatile compounds. Therefore, the diesel emission factors from USEPA (1998b) were used as surrogates for gasoline.

No data were found in the literature that quantified emissions from the combustion of propane. Because no specific data for propane were located, natural gas was used as a surrogate for propane. Natural gas consists of a high percentage of methane (generally above 85%) and varying amounts of ethane, propane, butane, and inerts (typically nitrogen, carbon dioxide, and helium) (USEPA 1995a). Liquid petroleum gas (LPG), classified as propane, consists of approximately 95% propane and 5% ethane. Therefore, since natural gas has more impurities, it should be a conservative surrogate for propane. The emission factors reported in the USEPA Utilities Report (USEPA 1998b) for gas-fired utility plants were used for propane.

Emission factors used to estimate emissions of volatile compounds and PAHs due to the burning of wood were obtained from the *Effects of Appliance Type and Operating*

Variables on Woodstove Emissions (USEPA 1990b). This study assessed the effects on emissions from the combustion of wood by varying specific parameters -- i.e., stove type, wood type, altitude, and burn rate. Results from tests using a conventional stove burning pine wood were believed to best fit the conditions of burning wood during the drill tower scenario. Pine was selected because it is a cheaper wood, more things are constructed of pine wood, and during similar training scenarios, conducted at other Facilities, old worn-out pallets constructed of pine were used as a fuel source (Van Gundy 2000). Since the elevation of the Ruston area is between 135 and 340 ft results from the low altitude burns were used. The data from runs classified as low burn rates and high burn rates were obtained since the actually burn rate at the drill tower was unknown.

Emission factors used to estimate emissions of volatile compounds and PAHs due to the burning of hay were obtained from *Atomospheric Pollutant Emission Factors from Open Burning of Agricultural and Forest Biomass by Wind Tunnel Simulations, Volume 1* (Jenkins *et al.* 1996). This study evaluated the potential emissions produced from the burning of a number of agricultural and forest products, including rice straw, wheat straw, barley straw, corn stover, and prunings of certain trees. Since the source material for the hay used during the drill tower training scenario was unknown, a surrogate value from had to be selected. For this assessment, wheat straw was selected as a surrogate for the hay because the results indicated it produced more total PAHs and contained larger emission factors for certain metals, arsenic, cadmium, and nickel, which can be major contributors to carcinogenic risk and mercury, a major contributor to noncarcinogenic risk.

Estimated emission rates were calculated for metals, volatiles, semi-volatiles, and metals. A description of the methodology used to calculate the estimated emissions for all three scenarios is provided in Section 2.

6.1.2 Dose Response Toxicity Assessment

The next step in the risk assessment was to determine the toxicity of the chemicals evaluated in the risk assessment. These chemicals were evaluated for cancer and noncancer health impacts, using criteria established by federal and state agencies. The toxicological criteria used to evaluate potential health effects of oral exposures were cancer slope factors (CSFs) [in units of $(mg/kg/day)^{-1}$], used to characterize risks for potential carcinogens, and oral reference doses (RfDs) [in mg/kg/day], used to characterize potential noncancer health effects. With regard to inhalation exposures, the toxicological criteria were unit risk factors (URFs) [in units of $(\mu g/m^3)^{-1}$] for carcinogens and reference concentrations (RfCs) [in units of mg/m^3] for noncarcinogens.

A reference dose/concentration (RfD or RfC) is an estimate of the dose of a chemical that an individual may take in through various routes of exposure every day for a lifetime without experiencing an adverse health effect. It is developed for the most sensitive noncancer health impact and includes an UCF. The UCF is included to ensure that the RfD is protective of the most sensitive populations and accounts for inadequacies or uncertainties in the data. The RfD is considered a benchmark dose; that is, exposures below the RfD or RfC are unlikely to be associated with a health risk, but as exposures exceed this level, the probability of an adverse effect increases. CSFs are derived from toxicological or epidemiological studies, are developed using health protective assumptions, and are considered to be upper bound estimates of cancer potency.

All chemicals for which toxicity values were available were included in the direct inhalation pathway analysis. Analyses of the indirect pathways (e.g., ingestion of soil, vegetation, beef, milk, pork, poultry, eggs and fish) included all chemicals relevant to each pathway. Although VOCS have limited potential to bioaccumulate or persist in the environment, they were included in the indirect pathway analyses, as per the USEPA Guidance (1998a).

6.1.3 Exposure Assessment

There are numerous pathways by which people may be exposed to the potential emissions from the training scenarios. The risk assessment evaluated the pathways most likely to contribute significantly to estimates of risk. A demographic analysis of the area within a 10-km radius surrounding the Facility was conducted to identify activities of the surrounding population. The nearest resident was identified to be approximately 0.8 kilometers (km) (0.5 mile) north of the facility just off Arkansas Plant Road. No schools, day cares, retirement homes, or other establishment which would contain sensitive receptors was noted in the area. The majority of the individuals living within a 3 km radius of the facility are contained within the subdivisions of Copper Ridge and Stow Creek, located to the southwest and southeast of the facility, respectively.

To ensure that a risk assessment is comprehensive, the USEPA Guidance (1998a) has recommended evaluation of a subsistence farmer and subsistence farmer child, a subsistence fisher and subsistence fisher child, and an adult and child resident. To address the effects of emissions from the training scenario to an individual performing the scenarios, an industrial worker receptor was included in the assessment. These receptors are considered because they are likely to have the highest potential exposure to chemicals emitted from the training scenarios at the Facility. The pathways by which human receptors could be exposed to these emissions, also specified in the USEPA Guidance, include direct inhalation of air and ingestion of soil, surface water, and vegetables for all receptors. Although no waterbody in the area that would be impacted by the emissions from the training scenarios could be used as a source of drinking water, the ingestion of surface water pathway was addressed in this assessment in order to provide an upper-bound on the estimate of risk. Ingestion of locally produced beef, milk, pork, chicken, and eggs was considered for the subsistence farmer, and fish for the subsistence fisher. The estimated risk to the industrial worker was assessed through the direct inhalation pathway only.

The exposure assessment estimated exposure concentrations for each chemical and pathway of concern for each human receptor evaluated. The extent of exposure was determined by first estimating the chemical concentrations in the various media (e.g., air, soil, vegetation, beef, milk, pork, poultry, eggs, and fish) and then estimating the chemical intake for each chemical for each relevant pathway and for each receptor. Chemical concentrations in the various media were determined using a complex series of equations that provided steady-state estimates of the fate and transport of emitted chemicals in these environmental media. Both site-specific characteristics and chemical-specific physicochemical properties were required, and default values for most of the parameters used in these calculations were provided by USEPA Guidance (1998a). Estimates of chemical intake for each receptor from each and all relevant pathways were calculated using receptor-specific data (e.g., ingestion rates, body weight, breathing rates). Default values for each of these data points are given in the USEPA Guidance (1998a).

6.1.4 Risk Characterization

Estimates of ELCR and the potential noncancer hazard associated with emissions from the training scenario were calculated by combining estimates of intake with the toxicity values for each chemical, for each receptor and exposure pathway. ELCR is the risk of getting cancer from chemicals emitted during the training scenarios over and above an individual's background risk of getting cancer from other exposures. The overall or total cancer risk was estimated by summing the risk estimates for each chemical for each receptor/pathway combination. Total noncancer hazard was estimated by summing individual hazard quotients (HQs) for all chemicals having the same target organ. An HQ is the ratio of the calculated average daily intake divided by the RfD for that chemical. The hazard index (HI) is the sum of the HQ for each pathway for all chemicals having the same target organ. An HI less than one indicates that noncancer effects are unlikely to occur.

Estimates of ELCR and noncancer hazard were evaluated for direct and indirect exposure pathways and then compared with USEPA benchmark values (USEPA 1998a) of 1 in 100,000 for ELCR, an HI of 1.0 for noncarcinogenic chemicals, and an acute hazard quotient (AHQ) of 1.0 for the total exposure by all of the relevant pathways for any human receptor evaluated.

6.1.4.1 Uncertainties. In each step of a risk assessment, assumptions are made and parameters are used that are intended to be protective of human health and therefore not underestimate risk. However, the process involves some uncertainty because of the inability to measure all parameters and because of inherent variability in some parameters. Section 4.4 presents a detailed discussion of the uncertainties regarding selection of chemicals, toxicity of chemicals, and location of receptors. Briefly stated these uncertainties were

- Use of surrogate data from the USEPA Utilities Report for diesel, kerosene, aviation fuel, gasoline, and propane.
- Inclusion of the dioxin/furan congeners from the USEPA Utilities Report
- Use of emission factors estimated by the burning of wheat straw as opposed to the emission factors estimated using barley straw, rice straw, or corn stover.
- Effect on the air modeling of the assumptions made regarding the combustion process of the training scenarios.
- Use of the maximum off-site concentration and deposition values for the location of the potential receptor even though no actual receptor resides within a 3-km radius of the Facility.
- Use of the "Selected" Creek as the waterbody for the estimation of risks through the ingestion of surface water and the ingestion of fish.

6.1.4.2 Results. For the HHRA, estimates of ELCRs were calculated for the direct inhalation pathway and the indirect pathways. As show in Table 26 for the direct inhalation pathway and Table 27 for the indirect pathways, the subsistence farmer had the highest estimated total ELCR. Over all three scenarios, the subsistence farmer's estimated risk was 2.6×10^{-8} for the direct inhalation pathway and 4.1×10^{-7} for the indirect pathways as compared with the USEPA benchmark comparison level of 1 in a 100,000. The drill tower was the primary contributor to risk, accounting for 85% of the risk from the direct inhalation pathway and the majority of the risk associated with the indirect pathways.

Combining the direct inhalation and indirect pathways estimated lifetime cancer risk resulted in a value of 4.4×10^{-7}. This value indicates that there is a 4 in 10 million chance (risk) that an individual exposed to the potential emissions from the training scenarios would experience adverse effects, or stated differently, these estimates indicate that if 10 million persons were exposed as calculated for this assessment, then over a 70-year lifetime of exposure, 4 extra cancers in those 10 million people could, but not necessarily will, occur.

As discussed in Sections 4.3.1.2.1 for the ARFF scenario, 4.3.1.2.2 for the propane system scenario, and 4.3.1.2.3 for the drill tower scenario, none of the estimated noncarcinogenic HQ levels were above the 0.25 USEPA screening comparison level. In fact, the sum of the HQs over all the scenarios is less than 0.05, significantly less that the 0.25 screening comparison level.

In summary for the HHRA, the estimated air concentrations of chemicals potentially emitted from the training scenarios conducted at the Facility would not result in ELCR and noncancer HQs that exceed EPA's benchmark values that are considered to be health protective. This conclusion was true when considering each chemical individually and, when combining all chemicals classified as carcinogens or noncarcinogens.

6.2 Priority Pollutants

Priority pollutants – particulate matter (PM), sulfur oxides (SO_x), nitrogen oxides (NO_x), and carbon monoxide (CO) – do not have standard toxicity values, such as a CSF or an RfD. Rather, these chemicals have promulgated ambient air standards that cannot be exceeded. These compounds were evaluated only for the direct inhalation pathway.

Information regarding the potential for the formation of the priority pollutants was obtained from the Chapter 1 of the *Compilation of Air Pollutant Emission Factors, Volume 1, Stationary Point and Area Sources* (USEPA 1995a) for the burning of diesel, propane, and wood. The emission factors used to estimate emissions from the combustion of hay for priority pollutants were taken from *Atomospheric Pollutant Emission Factors from Open Burning of Agricultural and Forest Biomass by Wind Tunnel Simulations, Volume 2* (Jenkins *et al.*, 1996).

The comparison of the estimated maximum 1-hour and average annual priority pollutant concentrations with their respective NAAQS standard was presented in Table 33 and Table 34, respectively. The comparison of the priority pollutants, PM, CO, NO_x, and SO_x, as detailed in Section 5, were all well below their respective NAAQS. A summary of these comparisons are presented in Tables 33 and 34. In all cases the estimated concentrations of the priority pollutants was less than the applicable standard.

6.3 Conclusions

Based upon the air quality impact statement presented within this report, it can be concluded that potential emissions from the conduct of training scenarios at the hypothetical Firefighter Training Center will not pose an unacceptable risk to human health. A comparison of the priority pollutants indicated that no potential adverse effects from the potential emissions from the training scenarios performed at the Facility.

APPENDIX

INTERMEDIATE TABLES PRESENTING CALCULATED MEDIA CONCENTRATIONS AND INTAKES AND RECEPTOR SPECIFIC INTAKES, RISKS, AND HAZARDS

Table 35a Estimates of Air Concentrations for the ARFF Scenario

Chemical	Subsistence Farmer (µg/m³)	Subsistence Farmer Child (µg/m³)	Subsistence Fisher (µg/m³)	Subsistence Fisher Child (µg/m³)	Adult Resident (µg/m³)	Child Resident (µg/m³)	Facility Worker (µg/m³)
Carcinogens							
Acetaldehyde	7.73E-08	7.73E-08	7.73E-08	7.73E-08	7.73E-08	7.73E-08	7.73E-08
Benzene	1.32E-08	1.32E-08	1.32E-08	1.32E-08	1.32E-08	1.32E-08	1.32E-08
Methylene Chloride	3.04E-07	3.04E-07	3.04E-07	3.04E-07	3.04E-07	3.04E-07	3.04E-07
Tetrachloroethylene	5.19E-09	5.19E-09	5.19E-09	5.19E-09	5.19E-09	5.19E-09	5.19E-09
Benzo[a]anthracene	2.83E-10	2.83E-10	2.83E-10	2.83E-10	2.83E-10	2.83E-10	2.83E-10
Benzo[b]fluoranthene	3.11E-10	3.11E-10	3.11E-10	3.11E-10	3.11E-10	3.11E-10	3.11E-10
Chrysene	1.98E-10	1.98E-10	1.98E-10	1.98E-10	1.98E-10	1.98E-10	1.98E-10
Dibenz[a,h]anthracene	7.54E-11	7.54E-11	7.54E-11	7.54E-11	7.54E-11	7.54E-11	7.54E-11
Formaldehyde	2.83E-07	2.83E-07	2.83E-07	2.83E-07	2.83E-07	2.83E-07	2.83E-07
Indeno[1,2,3-cd]pyrene	2.27E-10	2.27E-10	2.27E-10	2.27E-10	2.27E-10	2.27E-10	2.27E-10
2,3,7,8-TCDDioxin Toxicity Equivalents	2.92E-12	2.92E-12	2.92E-12	2.92E-12	2.92E-12	2.92E-12	2.92E-12
Arsenic	1.57E-07	1.57E-07	1.57E-07	1.57E-07	1.57E-07	1.57E-07	1.57E-07
Beryllium	1.39E-08	1.39E-08	1.39E-08	1.39E-08	1.39E-08	1.39E-08	1.39E-08
Cadmium	1.03E-08	1.03E-08	1.03E-08	1.03E-08	1.03E-08	1.03E-08	1.03E-08
Chromium VI	1.60E-07	1.60E-07	1.60E-07	1.60E-07	1.60E-07	1.60E-07	1.60E-07
Nickel	1.34E-05	1.34E-05	1.34E-05	1.34E-05	1.34E-05	1.34E-05	1.34E-05
Noncarcinogens							
Acetaldehyde	7.73E-08	7.73E-08	7.73E-08	7.73E-08	7.73E-08	7.73E-08	7.73E-08
Benzene	1.32E-08	1.32E-08	1.32E-08	1.32E-08	1.32E-08	1.32E-08	1.32E-08
Ethylbenzene	4.62E-09	4.62E-09	4.62E-09	4.62E-09	4.62E-09	4.62E-09	4.62E-09
Methyl Chloroform	7.16E-08	7.16E-08	7.16E-08	7.16E-08	7.16E-08	7.16E-08	7.16E-08
Methylene Chloride	3.04E-07	3.04E-07	3.04E-07	3.04E-07	3.04E-07	3.04E-07	3.04E-07
Tetrachloroethylene	5.19E-09	5.19E-09	5.19E-09	5.19E-09	5.19E-09	5.19E-09	5.19E-09

Table 35a (continued)

Chemical	Subsistence Farmer (μg/m^3)	Subsistence Farmer Child (μg/m^3)	Subsistence Fisher (μg/m^3)	Subsistence Fisher Child (μg/m^3)	Adult Resident (μg/m^3)	Child Resident (μg/m^3)	Facility Worker (μg/m^3)
o-Xylene	7.92E-09	7.92E-09	7.92E-09	7.92E-09	7.92E-09	7.92E-09	7.92E-09
p-Xylene	1.27E-08	1.27E-08	1.27E-08	1.27E-08	1.27E-08	1.27E-08	1.27E-08
2-Methylnaphthalene	1.60E-10	1.60E-10	1.60E-10	1.60E-10	1.60E-10	1.60E-10	1.60E-10
Acenaphthene	3.38E-09	3.38E-09	3.38E-09	3.38E-09	3.38E-09	3.38E-09	3.38E-09
Acenaphthylene	1.60E-10	1.60E-10	1.60E-10	1.60E-10	1.60E-10	1.60E-10	1.60E-10
Anthracene	1.41E-10	1.41E-10	1.41E-10	1.41E-10	1.41E-10	1.41E-10	1.41E-10
Benzo(g,h,i)perylene	1.98E-10	1.98E-10	1.98E-10	1.98E-10	1.98E-10	1.98E-10	1.98E-10
Fluoranthene	1.51E-10	1.51E-10	1.51E-10	1.51E-10	1.51E-10	1.51E-10	1.51E-10
Fluorene	1.98E-10	1.98E-10	1.98E-10	1.98E-10	1.98E-10	1.98E-10	1.98E-10
Formaldehyde	2.83E-07	2.83E-07	2.83E-07	2.83E-07	2.83E-07	2.83E-07	2.83E-07
Manganese	1.62E-07	1.62E-07	1.62E-07	1.62E-07	1.62E-07	1.62E-07	1.62E-07
Naphthalene	3.20E-09	3.20E-09	3.20E-09	3.20E-09	3.20E-09	3.20E-09	3.20E-09
Phenol	2.29E-07	2.29E-07	2.29E-07	2.29E-07	2.29E-07	2.29E-07	2.29E-07
Pyrene	3.49E-10	3.49E-10	3.49E-10	3.49E-10	3.49E-10	3.49E-10	3.49E-10
Arsenic	1.57E-07	1.57E-07	1.57E-07	1.57E-07	1.57E-07	1.57E-07	1.57E-07
Beryllium	1.39E-08	1.39E-08	1.39E-08	1.39E-08	1.39E-08	1.39E-08	1.39E-08
Cadmium	1.03E-08	1.03E-08	1.03E-08	1.03E-08	1.03E-08	1.03E-08	1.03E-08
Chlorine	6.75E-05	6.75E-05	6.75E-05	6.75E-05	6.75E-05	6.75E-05	6.75E-05
Chromium	1.60E-07	1.60E-07	1.60E-07	1.60E-07	1.60E-07	1.60E-07	1.60E-07
Chromium VI	1.60E-07	1.60E-07	1.60E-07	1.60E-07	1.60E-07	1.60E-07	1.60E-07
Nickel	1.34E-05	1.34E-05	1.34E-05	1.34E-05	1.34E-05	1.34E-05	1.34E-05
Selenium	4.90E-08	4.90E-08	4.90E-08	4.90E-08	4.90E-08	4.90E-08	4.90E-08

Table 35b Estimates of Air Concentrations for the Propane Scenario

Chemical	Subsistence Farmer ($\mu g/m^3$)	Subsistence Farmer Child ($\mu g/m^3$)	Subsistence Fisher ($\mu g/m^3$)	Subsistence Fisher Child ($\mu g/m^3$)	Adult Resident ($\mu g/m^3$)	Child Resident ($\mu g/m^3$)	Facility Worker ($\mu g/m^3$)
Carcinogens							
Benzene	1.12E-07	1.12E-07	1.12E-07	1.12E-07	1.12E-07	1.12E-07	1.12E-07
Formaldehyde	2.33E-06	2.33E-06	2.33E-06	2.33E-06	2.33E-06	2.33E-06	2.33E-06
Arsenic	2.19E-09	2.19E-09	2.19E-09	2.19E-09	2.19E-09	2.19E-09	2.19E-09
Nickel	1.13E-07	1.13E-07	1.13E-07	1.13E-07	1.13E-07	1.13E-07	1.13E-07
Noncarcinogens							
Benzene	1.12E-07	1.12E-07	1.12E-07	1.12E-07	1.12E-07	1.12E-07	1.12E-07
Toluene	8.19E-07	8.19E-07	8.19E-07	8.19E-07	8.19E-07	8.19E-07	8.19E-07
2-Methylnaphthalene	2.09E-09	2.09E-09	2.09E-09	2.09E-09	2.09E-09	2.09E-09	2.09E-09
Fluoranthene	2.41E-10	2.41E-10	2.41E-10	2.41E-10	2.41E-10	2.41E-10	2.41E-10
Fluorene	2.41E-10	2.41E-10	2.41E-10	2.41E-10	2.41E-10	2.41E-10	2.41E-10
Formaldehyde	2.33E-06	2.33E-06	2.33E-06	2.33E-06	2.33E-06	2.33E-06	2.33E-06
Naphthalene	5.37E-08	5.37E-08	5.37E-08	5.37E-08	5.37E-08	5.37E-08	5.37E-08
Pyrene	4.01E-10	4.01E-10	4.01E-10	4.01E-10	4.01E-10	4.01E-10	4.01E-10
Arsenic	2.19E-09	2.19E-09	2.19E-09	2.19E-09	2.19E-09	2.19E-09	2.19E-09
Nickel	1.13E-07	1.13E-07	1.13E-07	1.13E-07	1.13E-07	1.13E-07	1.13E-07

Table 35c Estimates of Air Concentrations for the Drill Tower Scenario

Chemical	Subsistence Farmer (μg/m^3)	Subsistence Farmer Child (μg/m^3)	Subsistence Fisher (μg/m^3)	Subsistence Fisher Child (μg/m^3)	Adult Resident (μg/m^3)	Child Resident (μg/m^3)	Facility Worker (μg/m^3)
Carcinogens							
Benzene	2.29E-03	2.29E-03	2.29E-03	2.29E-03	2.29E-03	2.29E-03	2.29E-03
Benzo(a)pyrene	5.41E-06	5.41E-06	5.41E-06	5.41E-06	5.41E-06	5.41E-06	5.41E-06
Benzo[a]anthracene	2.64E-05	2.64E-05	2.64E-05	2.64E-05	2.64E-05	2.64E-05	2.64E-05
Benzo[b]fluoranthene	1.12E-05	1.12E-05	1.12E-05	1.12E-05	1.12E-05	1.12E-05	1.12E-05
Benzo[k]fluoranthene	3.93E-06	3.93E-06	3.93E-06	3.93E-06	3.93E-06	3.93E-06	3.93E-06
Chrysene	2.36E-05	2.36E-05	2.36E-05	2.36E-05	2.36E-05	2.36E-05	2.36E-05
Dibenz[a,h]anthracene	1.50E-06	1.50E-06	1.50E-06	1.50E-06	1.50E-06	1.50E-06	1.50E-06
Indeno[1,2,3-cd]pyrene	2.93E-06	2.93E-06	2.93E-06	2.93E-06	2.93E-06	2.93E-06	2.93E-06
Arsenic	5.51E-08	5.51E-08	5.51E-08	5.51E-08	5.51E-08	5.51E-08	5.51E-08
Cadmium	3.82E-06	3.82E-06	3.82E-06	3.82E-06	3.82E-06	3.82E-06	3.82E-06
Chromium VI	3.48E-07	3.48E-07	3.48E-07	3.48E-07	3.48E-07	3.48E-07	3.48E-07
Nickel	2.56E-07	2.56E-07	2.56E-07	2.56E-07	2.56E-07	2.56E-07	2.56E-07
Noncarcinogens							
Benzaldehyde	2.00E-04	2.00E-04	2.00E-04	2.00E-04	2.00E-04	2.00E-04	2.00E-04
Benzene	2.29E-03	2.29E-03	2.29E-03	2.29E-03	2.29E-03	2.29E-03	2.29E-03
Methyl Ethyl Ketone (MEK)	1.19E-04	1.19E-04	1.19E-04	1.19E-04	1.19E-04	1.19E-04	1.19E-04
Styrene	5.29E-04	5.29E-04	5.29E-04	5.29E-04	5.29E-04	5.29E-04	5.29E-04
Toluene	8.39E-04	8.39E-04	8.39E-04	8.39E-04	8.39E-04	8.39E-04	8.39E-04
o-Xylene	3.42E-04	3.42E-04	3.42E-04	3.42E-04	3.42E-04	3.42E-04	3.42E-04
2-Methylnaphthalene	6.22E-06	6.22E-06	6.22E-06	6.22E-06	6.22E-06	6.22E-06	6.22E-06
Acenaphthene	3.09E-05	3.09E-05	3.09E-05	3.09E-05	3.09E-05	3.09E-05	3.09E-05
Acenaphthylene	1.59E-04	1.59E-04	1.59E-04	1.59E-04	1.59E-04	1.59E-04	1.59E-04
Anthracene	1.62E-05	1.62E-05	1.62E-05	1.62E-05	1.62E-05	1.62E-05	1.62E-05

Table 35c (continued)

Chemical	Subsistence Farmer (μg/m³)	Subsistence Farmer Child (μg/m³)	Subsistence Fisher (μg/m³)	Subsistence Fisher Child (μg/m³)	Adult Resident (μg/m³)	Child Resident (μg/m³)	Facility Worker (μg/m³)
Benzo(g,h,i)perylene	9.39E-06	9.39E-06	9.39E-06	9.39E-06	9.39E-06	9.39E-06	9.39E-06
Fluoranthene	4.02E-05	4.02E-05	4.02E-05	4.02E-05	4.02E-05	4.02E-05	4.02E-05
Fluorene	1.76E-05	1.76E-05	1.76E-05	1.76E-05	1.76E-05	1.76E-05	1.76E-05
Furans	2.39E-04	2.39E-04	2.39E-04	2.39E-04	2.39E-04	2.39E-04	2.39E-04
Manganese	1.09E-06	1.09E-06	1.09E-06	1.09E-06	1.09E-06	1.09E-06	1.09E-06
Naphthalene	1.39E-03	1.39E-03	1.39E-03	1.39E-03	1.39E-03	1.39E-03	1.39E-03
Phenol	2.78E-04	2.78E-04	2.78E-04	2.78E-04	2.78E-04	2.78E-04	2.78E-04
Pyrene	3.51E-05	3.51E-05	3.51E-05	3.51E-05	3.51E-05	3.51E-05	3.51E-05
n-Hexane	2.32E-04	2.32E-04	2.32E-04	2.32E-04	2.32E-04	2.32E-04	2.32E-04
Antimony	2.45E-06	2.45E-06	2.45E-06	2.45E-06	2.45E-06	2.45E-06	2.45E-06
Arsenic	5.51E-08	5.51E-08	5.51E-08	5.51E-08	5.51E-08	5.51E-08	5.51E-08
Barium	2.51E-04	2.51E-04	2.51E-04	2.51E-04	2.51E-04	2.51E-04	2.51E-04
Cadmium	3.82E-06	3.82E-06	3.82E-06	3.82E-06	3.82E-06	3.82E-06	3.82E-06
Chlorine	5.64E-03	5.64E-03	5.64E-03	5.64E-03	5.64E-03	5.64E-03	5.64E-03
Chromium	3.48E-07	3.48E-07	3.48E-07	3.48E-07	3.48E-07	3.48E-07	3.48E-07
Chromium VI	3.48E-07	3.48E-07	3.48E-07	3.48E-07	3.48E-07	3.48E-07	3.48E-07
Nickel	2.56E-07	2.56E-07	2.56E-07	2.56E-07	2.56E-07	2.56E-07	2.56E-07
Selenium	1.75E-07	1.75E-07	1.75E-07	1.75E-07	1.75E-07	1.75E-07	1.75E-07
Silver	2.27E-06	2.27E-06	2.27E-06	2.27E-06	2.27E-06	2.27E-06	2.27E-06
Zinc	4.02E-06	4.02E-06	4.02E-06	4.02E-06	4.02E-06	4.02E-06	4.02E-06

Table 36a Estimates of Soil Concentrations for the ARRF Scenario

Chemical	Subsistence Farmer (mg/kg)	Subsistence Farmer Child (mg/kg)	Subsistence Fisher (mg/kg)	Subsistence Fisher Child (mg/kg)	Adult Resident (mg/kg)	Child Resident (mg/kg)
Carcinogens						
Acetaldehyde	1.07E-08	1.43E-08	1.43E-08	1.43E-08	1.43E-08	1.43E-08
Benzene	3.20E-12	4.27E-12	4.27E-12	4.27E-12	4.27E-12	4.27E-12
Methylene Chloride	3.69E-11	4.92E-11	4.92E-11	4.92E-11	4.92E-11	4.92E-11
Tetrachloroethylene	2.77E-12	3.70E-12	3.70E-12	3.70E-12	3.70E-12	3.70E-12
Benzo[a]anthracene	3.32E-08	4.07E-08	4.07E-08	4.07E-08	4.07E-08	4.07E-08
Benzo[b]fluoranthene	3.23E-08	3.98E-08	3.98E-08	3.98E-08	3.98E-08	3.98E-08
Chrysene	2.97E-08	3.50E-08	3.50E-08	3.50E-08	3.50E-08	3.50E-08
Dibenz[a,h]anthracene	1.21E-09	1.42E-09	1.42E-09	1.42E-09	1.42E-09	1.42E-09
Formaldehyde	1.34E-11	1.79E-11	1.79E-11	1.79E-11	1.79E-11	1.79E-11
Indeno[1,2,3-cd]pyrene	2.72E-09	3.29E-09	3.29E-09	3.29E-09	3.29E-09	3.29E-09
2,3,7,8-TCDDioxin Toxicity Equivalents	1.53E-11	1.51E-11	1.51E-11	1.51E-11	1.51E-11	1.51E-11
Arsenic	3.24E-07	4.24E-07	4.24E-07	4.24E-07	4.24E-07	4.24E-07
Beryllium	6.12E-07	5.98E-07	5.98E-07	5.98E-07	5.98E-07	5.98E-07
Noncarcinogens						
Acetaldehyde	1.07E-08	1.43E-08	1.43E-08	1.43E-08	1.43E-08	1.43E-08
Benzene	3.20E-12	4.27E-12	4.27E-12	4.27E-12	4.27E-12	4.27E-12
Ethylbenzene	4.01E-12	5.34E-12	5.34E-12	5.34E-12	5.34E-12	5.34E-12
Methyl Chloroform	2.78E-08	3.71E-08	3.71E-08	3.71E-08	3.71E-08	3.71E-08
Methylene Chloride	3.69E-11	4.92E-11	4.92E-11	4.92E-11	4.92E-11	4.92E-11
Tetrachloroethylene	2.77E-12	3.70E-12	3.70E-12	3.70E-12	3.70E-12	3.70E-12
Toluene	4.45E-11	5.94E-11	5.94E-11	5.94E-11	5.94E-11	5.94E-11
Vinyl Acetate	1.11E-11	1.48E-11	1.48E-11	1.48E-11	1.48E-11	1.48E-11
o-Xylene	1.01E-11	1.35E-11	1.35E-11	1.35E-11	1.35E-11	1.35E-11
p-Xylene	2.16E-15	2.88E-15	2.88E-15	2.88E-15	2.88E-15	2.88E-15

Table 36a (continued)

Chemical	Subsistence Farmer (mg/kg)	Subsistence Farmer Child (mg/kg)	Subsistence Fisher (mg/kg)	Subsistence Fisher Child (mg/kg)	Adult Resident (mg/kg)	Child Resident (mg/kg)
2-Methylnaphthalene	6.23E-11	8.30E-11	8.30E-11	8.30E-11	8.30E-11	8.30E-11
Acenaphthene	7.18E-11	9.57E-11	9.57E-11	9.57E-11	9.57E-11	9.57E-11
Acenaphthylene	5.29E-10	7.04E-10	7.04E-10	7.04E-10	7.04E-10	7.04E-10
Anthracene	1.86E-09	2.46E-09	2.46E-09	2.46E-09	2.46E-09	2.46E-09
Benzo(g,h,i)perylene	3.55E-08	2.88E-08	2.88E-08	2.88E-08	2.88E-08	2.88E-08
Fluoranthene	9.95E-09	1.27E-08	1.27E-08	1.27E-08	1.27E-08	1.27E-08
Fluorene	1.38E-12	1.84E-12	1.84E-12	1.84E-12	1.84E-12	1.84E-12
Formaldehyde	1.34E-11	1.79E-11	1.79E-11	1.79E-11	1.79E-11	1.79E-11
Manganese	1.53E-09	2.03E-09	2.03E-09	2.03E-09	2.03E-09	2.03E-09
Naphthalene	3.70E-10	4.93E-10	4.93E-10	4.93E-10	4.93E-10	4.93E-10
Phenol	5.35E-08	7.13E-08	7.13E-08	7.13E-08	7.13E-08	7.13E-08
Pyrene	4.02E-13	5.35E-13	5.35E-13	5.35E-13	5.35E-13	5.35E-13
Arsenic	3.24E-07	4.24E-07	4.24E-07	4.24E-07	4.24E-07	4.24E-07
Beryllium	6.12E-07	5.98E-07	5.98E-07	5.98E-07	5.98E-07	5.98E-07
Cadmium	5.46E-08	6.94E-08	6.94E-08	6.94E-08	6.94E-08	6.94E-08
Chlorine	8.73E-06	1.16E-05	1.16E-05	1.16E-05	1.16E-05	1.16E-05
Chromium	1.54E-05	1.23E-05	1.23E-05	1.23E-05	1.23E-05	1.23E-05
Chromium VI	2.16E-07	2.85E-07	2.85E-07	2.85E-07	2.85E-07	2.85E-07
Nickel	6.15E-05	7.88E-05	7.88E-05	7.88E-05	7.88E-05	7.88E-05
Selenium	1.77E-08	2.36E-08	2.36E-08	2.36E-08	2.36E-08	2.36E-08

Table 36b Estimates of Soil Concentrations for the Propane Scenario

Chemical	Subsistence Farmer (mg/kg)	Subsistence Farmer Child (mg/kg)	Subsistence Fisher (mg/kg)	Subsistence Fisher Child (mg/kg)	Adult Resident (mg/kg)	Child Resident (mg/kg)
Carcinogens						
Benzene	2.45E-11	3.27E-11	3.27E-11	3.27E-11	3.27E-11	3.27E-11
Formaldehyde	9.93E-11	1.32E-10	1.32E-10	1.32E-10	1.32E-10	1.32E-10
Arsenic	1.01E-09	1.32E-09	1.32E-09	1.32E-09	1.32E-09	1.32E-09
Noncarcinogens						
Benzene	2.45E-11	3.27E-11	3.27E-11	3.27E-11	3.27E-11	3.27E-11
Toluene	4.35E-10	5.80E-10	5.80E-10	5.80E-10	5.80E-10	5.80E-10
2-Methylnaphthalene	7.31E-10	9.74E-10	9.74E-10	9.74E-10	9.74E-10	9.74E-10
Fluoranthene	1.43E-08	1.82E-08	1.82E-08	1.82E-08	1.82E-08	1.82E-08
Fluorene	1.51E-12	2.01E-12	2.01E-12	2.01E-12	2.01E-12	2.01E-12
Formaldehyde	9.93E-11	1.32E-10	1.32E-10	1.32E-10	1.32E-10	1.32E-10
Naphthalene	5.58E-09	7.44E-09	7.44E-09	7.44E-09	7.44E-09	7.44E-09
Pyrene	4.16E-13	5.55E-13	5.55E-13	5.55E-13	5.55E-13	5.55E-13
Arsenic	1.01E-09	1.32E-09	1.32E-09	1.32E-09	1.32E-09	1.32E-09
Nickel	1.17E-07	1.50E-07	1.50E-07	1.50E-07	1.50E-07	1.50E-07

Table 36c Estimates of Soil Concentrations for the Drill Tower Scenario

Chemical	Subsistence Farmer (mg/kg)	Subsistence Farmer Child (mg/kg)	Subsistence Fisher (mg/kg)	Subsistence Fisher Child (mg/kg)	Adult Resident (mg/kg)	Child Resident (mg/kg)
Carcinogens						
Benzene	5.13E-07	6.83E-07	6.83E-07	6.83E-07	6.83E-07	6.83E-07
Benzo(a)pyrene	2.16E-04	2.68E-04	2.68E-04	2.68E-04	2.68E-04	2.68E-04
Benzo[a]anthracene	2.90E-03	3.55E-03	3.55E-03	3.55E-03	3.55E-03	3.55E-03
Benzo[b]flouranthene	1.10E-03	1.35E-03	1.35E-03	1.35E-03	1.35E-03	1.35E-03
Benzo[k]fluoranthene	4.21E-04	4.48E-04	4.48E-04	4.48E-04	4.48E-04	4.48E-04
Chrysene	3.36E-03	3.97E-03	3.97E-03	3.97E-03	3.97E-03	3.97E-03
Dibenz[a,h]anthracene	2.88E-04	3.40E-04	3.40E-04	3.40E-04	3.40E-04	3.40E-04
Indeno[1,2,3-cd]pyrene	4.43E-04	5.36E-04	5.36E-04	5.36E-04	5.36E-04	5.36E-04
Arsenic	1.56E-06	2.04E-06	2.04E-06	2.04E-06	2.04E-06	2.04E-06
Chromium VI	6.46E-06	8.51E-06	8.51E-06	8.51E-06	8.51E-06	8.51E-06
Noncarcinogens						
Benzaldehyde	3.00E-06	4.00E-06	4.00E-06	4.00E-06	4.00E-06	4.00E-06
Benzene	5.13E-07	6.83E-07	6.83E-07	6.83E-07	6.83E-07	6.83E-07
Methyl Ethyl Ketone (MEK)	1.31E-07	1.74E-07	1.74E-07	1.74E-07	1.74E-07	1.74E-07
Styrene	4.33E-06	5.78E-06	5.78E-06	5.78E-06	5.78E-06	5.78E-06
Toluene	4.56E-07	6.09E-07	6.09E-07	6.09E-07	6.09E-07	6.09E-07
o-Xylene	4.04E-07	5.38E-07	5.38E-07	5.38E-07	5.38E-07	5.38E-07
2-Methylnaphthalene	2.23E-06	2.97E-06	2.97E-06	2.97E-06	2.97E-06	2.97E-06
Acenaphthene	6.05E-07	8.06E-07	8.06E-07	8.06E-07	8.06E-07	8.06E-07
Acenaphthylene	4.84E-04	6.44E-04	6.44E-04	6.44E-04	6.44E-04	6.44E-04
Anthracene	1.98E-04	2.61E-04	2.61E-04	2.61E-04	2.61E-04	2.61E-04
Benzo(g,h,i)perylene	2.44E-03	1.98E-03	1.98E-03	1.98E-03	1.98E-03	1.98E-03
Fluoranthene	2.44E-03	3.12E-03	3.12E-03	3.12E-03	3.12E-03	3.12E-03
Fluorene	1.13E-07	1.50E-07	1.50E-07	1.50E-07	1.50E-07	1.50E-07

Table 36c (continued)

Chemical	Subsistence Farmer (mg/kg)	Subsistence Farmer Child (mg/kg)	Subsistence Fisher (mg/kg)	Subsistence Fisher Child (mg/kg)	Adult Resident (mg/kg)	Child Resident (mg/kg)
Furans	2.07E-08	2.76E-08	2.76E-08	2.76E-08	2.76E-08	2.76E-08
Manganese	1.41E-07	1.88E-07	1.88E-07	1.88E-07	1.88E-07	1.88E-07
Naphthalene	1.48E-04	1.97E-04	1.97E-04	1.97E-04	1.97E-04	1.97E-04
Phenol	5.96E-05	7.95E-05	7.95E-05	7.95E-05	7.95E-05	7.95E-05
Pyrene	3.73E-08	4.98E-08	4.98E-08	4.98E-08	4.98E-08	4.98E-08
n-Hexane	1.15E-09	1.53E-09	1.53E-09	1.53E-09	1.53E-09	1.53E-09
Antimony	1.07E-04	1.39E-04	1.39E-04	1.39E-04	1.39E-04	1.39E-04
Arsenic	1.56E-06	2.04E-06	2.04E-06	2.04E-06	2.04E-06	2.04E-06
Barium	1.00E-02	1.30E-02	1.30E-02	1.30E-02	1.30E-02	1.30E-02
Cadmium	2.79E-04	3.54E-04	3.54E-04	3.54E-04	3.54E-04	3.54E-04
Chlorine	6.72E-04	8.95E-04	8.95E-04	8.95E-04	8.95E-04	8.95E-04
Chromium	4.59E-04	3.68E-04	3.68E-04	3.68E-04	3.68E-04	3.68E-04
Chromium VI	6.46E-06	8.51E-06	8.51E-06	8.51E-06	8.51E-06	8.51E-06
Nickel	1.62E-05	2.08E-05	2.08E-05	2.08E-05	2.08E-05	2.08E-05
Selenium	8.73E-07	1.16E-06	1.16E-06	1.16E-06	1.16E-06	1.16E-06
Silver	1.86E-05	2.47E-05	2.47E-05	2.47E-05	2.47E-05	2.47E-05
Zinc	2.43E-04	3.11E-04	3.11E-04	3.11E-04	3.11E-04	3.11E-04

Table 37a Estimates of Vegetation Concentrations for the ARRF Scenario

Chemical	All Receptors		Farmer Receptor		All Other Receptors	
	Pd[a]	Pv[b]	Pr[c]	Prag[d]	Pr[c]	Prag[d]
2,3,7,8-TCDDioxin Toxcity Equivalents	4.45E-14	2.31E-14	6.59E-14	1.51E-13	6.47E-14	1.49E-13
2-Methylnaphthalene	NC	5.57E-15	1.71E-11	3.27E-11	2.27E-11	4.36E-11
Acenaphthene	NC	1.43E-11	1.42E-11	3.93E-10	1.89E-11	5.24E-10
Acenaphthylene	NC	6.70E-15	1.08E-10	2.56E-10	1.44E-10	3.41E-10
Acetaldehyde	NC	NC	5.55E-07	7.25E-06	7.40E-07	9.67E-06
Anthracene	NC	3.41E-14	1.88E-10	5.14E-11	2.49E-10	6.80E-11
Arsenic	3.49E-08	NC	2.05E-09	2.59E-09	2.68E-09	3.39E-09
Benzene	NC	2.11E-14	7.20E-12	8.54E-11	9.60E-12	1.14E-10
Benzo(g,h,i)perylene	9.72E-11	1.17E-17	1.85E-10	9.77E-11	1.50E-10	7.92E-11
Benzo[a]anthracene	1.76E-11	3.57E-11	6.71E-10	7.01E-10	8.21E-10	8.58E-10
Benzo[b]flouranthene	2.90E-11	7.78E-11	3.26E-10	5.36E-10	4.01E-10	6.60E-10
Beryllium	6.45E-09	NC	1.58E-09	6.43E-10	1.54E-09	6.28E-10
Cadmium	4.77E-09	NC	6.82E-09	3.49E-09	8.67E-09	4.44E-09
Chlorine	NC	NC	NC	NC	NC	NC
Chromium	7.42E-08	NC	7.51E-08	6.93E-08	6.01E-08	5.54E-08
Chromium VI	7.42E-08	NC	1.06E-09	9.74E-10	1.39E-09	1.28E-09
Chrysene	2.48E-11	7.51E-11	5.55E-10	6.08E-10	6.55E-10	7.18E-10
Dibenz[a,h]anthracene	3.46E-11	3.24E-10	7.67E-12	1.72E-11	9.05E-12	2.03E-11
Ethylbenzene	NC	5.89E-14	2.43E-12	1.28E-10	3.24E-12	1.71E-10
Fluoranthene	6.33E-13	1.95E-12	4.44E-10	3.88E-10	5.67E-10	4.96E-10
Fluorene	9.56E-15	3.47E-14	2.08E-13	6.85E-14	2.78E-13	9.13E-14
Formaldehyde	NC	1.10E-13	3.30E-10	3.44E-09	4.39E-10	4.59E-09
Indeno[1,2,3-cd]pyrene	1.04E-10	3.53E-09	1.06E-11	3.23E-11	1.28E-11	3.91E-11
Lead	3.37E-07	NC	4.70E-07	3.11E-07	4.51E-07	2.98E-07
Manganese	7.51E-08	NC	NC	NC	NC	NC

Table 37a (continued)

Chemical	All Receptors		Farmer Receptor		All Other Receptors	
	Pd[a]	Pv[b]	Pr[c]	Prag[d]	Pr[c]	Prag[d]
Methyl Chloroform	NC	6.80E-14	4.29E-08	4.82E-10	5.71E-08	6.42E-10
Methylene Chloride	NC	1.29E-13	2.69E-10	3.12E-09	3.59E-10	4.16E-09
Naphthalene	NC	1.21E-12	1.61E-10	3.04E-09	2.14E-10	4.06E-09
Nickel	6.20E-06	NC	5.73E-07	4.92E-07	7.33E-07	6.30E-07
o-Xylene	NC	1.31E-13	6.09E-12	2.78E-10	8.12E-12	3.70E-10
Phenanthrene	NC	4.09E-17	1.80E-13	7.08E-14	2.39E-13	9.44E-14
Phenol	NC	6.73E-10	2.90E-07	2.31E-06	3.86E-07	3.08E-06
p-Xylene	NC	2.34E-13	1.23E-15	4.91E-14	1.64E-15	6.55E-14
Pyrene	9.80E-13	4.16E-12	2.00E-14	9.80E-15	2.67E-14	1.31E-14
Selenium	1.09E-08	NC	3.46E-10	3.90E-10	4.60E-10	5.19E-10
Tetrachloroethylene	NC	7.18E-15	3.63E-12	2.88E-11	4.84E-12	3.85E-11
Toluene	NC	3.98E-13	4.94E-11	1.04E-09	6.59E-11	1.38E-09
Vinyl Acetate	NC	2.28E-14	1.69E-10	1.58E-09	2.26E-10	2.11E-09

[a] - Aboveground produce concentration due to direct deposition.

[b] - Aboveground produce concentration due to air-to-plant transfer.

[c] - Belowground produce concentration due to root uptake.

[d] - Aboveground produce concentration due to root uptake.

NC - Not Calculated

Table 37b Estimates of Vegetation Concentrations for the Propane Scenario

Chemical	All Receptors		Farmer Receptor		All Other Receptors	
	Pd[a]	Pv[b]	Pr[c]	Prag[d]	Pr[c]	Prag[d]
2-Methylnaphthalene	NC	7.26E-14	2.00E-10	3.84E-10	2.67E-10	5.12E-10
Arsenic	2.24E-10	NC	6.38E-12	8.06E-12	8.35E-12	1.06E-11
Benzene	NC	1.80E-13	5.52E-11	6.55E-10	7.36E-11	8.73E-10
Fluoranthene	3.08E-13	3.11E-12	6.37E-10	5.57E-10	8.14E-10	7.12E-10
Fluorene	3.54E-15	4.22E-14	2.28E-13	7.49E-14	3.04E-13	9.98E-14
Formaldehyde	NC	9.03E-13	2.44E-09	2.55E-08	3.26E-09	3.40E-08
Lead	2.96E-08	NC	3.29E-08	2.18E-08	3.16E-08	2.09E-08
Naphthalene	NC	2.02E-11	2.43E-09	4.59E-08	3.24E-09	6.12E-08
Nickel	1.48E-08	NC	1.09E-09	9.35E-10	1.39E-09	1.20E-09
Phenanthrene	NC	1.81E-16	7.16E-13	2.82E-13	9.55E-13	3.76E-13
Pyrene	3.44E-13	4.79E-12	2.07E-14	1.01E-14	2.76E-14	1.35E-14
Toluene	NC	4.32E-12	4.83E-10	1.01E-08	6.44E-10	1.35E-08

[a] - Aboveground produce concentration due to direct deposition.

[b] - Aboveground produce concentration due to air-to-plant transfer.

[c] - Belowground produce concentration due to root uptake.

[d] - Aboveground produce concentration due to root uptake.

NC - Not Calculated

Table 37c Estimates of Vegetation Concentrations for the Drill Tower Scenario

Chemical	All Receptors		Farmer Receptor		All Other Receptors	
	Pd[a]	Pv[b]	Pr[c]	Prag[d]	Pr[c]	Prag[d]
2-Methylnaphthalene	NC	2.16E-10	6.11E-07	1.17E-06	8.14E-07	1.56E-06
Acenaphthene	NC	1.30E-07	1.20E-07	3.31E-06	1.60E-07	4.42E-06
Acenaphthylene	NC	6.65E-09	9.87E-05	2.34E-04	1.31E-04	3.12E-04
Anthracene	NC	3.92E-09	1.99E-05	5.45E-06	2.64E-05	7.21E-06
Antimony	2.31E-05	NC	3.42E-06	3.22E-06	4.43E-06	4.17E-06
Arsenic	5.21E-07	NC	9.87E-09	1.25E-08	1.29E-08	1.63E-08
Barium	2.41E-03	NC	3.23E-04	1.51E-04	4.20E-04	1.96E-04
Benzaldehyde	NC	8.35E-09	1.62E-05	1.41E-04	2.17E-05	1.89E-04
Benzene	NC	3.67E-09	1.15E-06	1.37E-05	1.54E-06	1.82E-05
Benzo(a)pyrene	5.69E-06	2.78E-06	2.40E-06	2.72E-06	2.97E-06	3.38E-06
Benzo(g,h,i)perylene	1.27E-05	5.80E-13	1.27E-05	6.71E-06	1.03E-05	5.44E-06
Benzo[a]anthracene	4.37E-06	3.35E-06	5.85E-05	6.11E-05	7.16E-05	7.48E-05
Benzo[b]fluoranthene	2.79E-06	2.83E-06	1.11E-05	1.82E-05	1.37E-05	2.24E-05
Benzo[k]fluoranthene	4.81E-06	2.74E-06	4.25E-06	6.99E-06	4.53E-06	7.44E-06
Cadmium	3.66E-05	NC	3.48E-05	1.78E-05	4.43E-05	2.27E-05
Chlorine	NC	NC	NC	NC	NC	NC
Chromium	3.33E-06	NC	2.24E-06	2.07E-06	1.79E-06	1.65E-06
Chromium VI	3.33E-06	NC	3.15E-08	2.91E-08	4.15E-08	3.83E-08
Chrysene	7.89E-06	9.02E-06	6.29E-05	6.89E-05	7.42E-05	8.14E-05
Dibenz[a,h]anthracene	1.41E-05	8.54E-06	1.83E-06	4.12E-06	2.16E-06	4.86E-06
Fluoranthene	4.45E-07	5.18E-07	1.09E-04	9.51E-05	1.39E-04	1.22E-04
Fluorene	2.24E-09	3.07E-09	1.70E-08	5.59E-09	2.27E-08	7.45E-09
Furans	NC	9.28E-10	1.31E-07	1.15E-07	1.75E-07	1.53E-07
Indeno[1,2,3-cd]pyrene	2.78E-05	6.08E-05	1.73E-06	5.27E-06	2.09E-06	6.38E-06
Lead	4.49E-06	NC	4.17E-06	2.76E-06	4.01E-06	2.65E-06

Table 37c (continued)

Chemical	All Receptors		Farmer Receptor		All Other Receptors	
	Pd[a]	Pv[b]	Pr[c]	Prag[d]	Pr[c]	Prag[d]
Manganese	1.05E-05	NC	NC	NC	NC	NC
Methyl Ethyl Ketone (MEK)	NC	3.04E-10	3.49E-06	3.74E-05	4.65E-06	4.99E-05
Naphthalene	NC	5.23E-07	6.42E-05	1.21E-03	8.56E-05	1.62E-03
n-Hexane	NC	1.86E-09	5.57E-10	2.67E-09	7.43E-10	3.56E-09
Nickel	2.45E-06	NC	1.51E-07	1.30E-07	1.93E-07	1.66E-07
o-Xylene	NC	5.68E-09	2.43E-07	1.11E-05	3.24E-07	1.48E-05
Phenanthrene	NC	1.55E-11	6.29E-08	2.48E-08	8.39E-08	3.31E-08
Phenol	NC	8.14E-07	3.23E-04	2.58E-03	4.31E-04	3.43E-03
Pyrene	2.61E-07	4.19E-07	1.86E-09	9.10E-10	2.48E-09	1.21E-09
Selenium	1.65E-06	NC	1.70E-08	1.92E-08	2.26E-08	2.55E-08
Silver	2.17E-05	NC	2.57E-06	1.86E-06	3.40E-06	2.47E-06
Styrene	NC	9.75E-09	3.40E-06	2.29E-05	4.53E-06	3.05E-05
Toluene	NC	4.43E-09	5.07E-07	1.06E-05	6.75E-07	1.42E-05
Zinc	3.85E-05	NC	1.75E-05	1.07E-05	2.24E-05	1.37E-05

[a] - Aboveground produce concentration due to direct deposition.

[b] - Aboveground produce concentration due to air-to-plant transfer.

[c] - Belowground produce concentration due to root uptake.

[d] - Aboveground produce concentration due to root uptake.

NC - Not Calculated

Table 38a Estimates of Beef Concentrations for the ARRF Scenario

Chemical	Subsistence Farmer (mg/kg)	Subsistence Farmer Child (mg/kg)	Subsistence Fisher (mg/kg)	Subsistence Fisher Child (mg/kg)	Adult Resident (mg/kg)	Child Resident (mg/kg)
Carcinogens						
Acetaldehyde	9.88E-14	1.32E-13	NA	NA	NA	NA
Benzene	2.98E-16	3.97E-16	NA	NA	NA	NA
Methylene Chloride	1.44E-15	1.92E-15	NA	NA	NA	NA
Tetrachloroethylene	3.90E-16	5.20E-16	NA	NA	NA	NA
Benzo[a]anthracene	NC	NC	NA	NA	NA	NA
Benzo[b]fluoranthene	NC	NC	NA	NA	NA	NA
Chrysene	NC	NC	NA	NA	NA	NA
Dibenz[a,h]anthracene	NC	NC	NA	NA	NA	NA
Formaldehyde	2.15E-16	2.87E-16	NA	NA	NA	NA
Indeno[1,2,3-cd]pyrene	NC	NC	NA	NA	NA	NA
2,3,7,8-TCDDioxin Toxicity Equivalents	1.43E-12	1.43E-12	NA	NA	NA	NA
Arsenic	8.03E-09	8.22E-09	NA	NA	NA	NA
Beryllium	1.07E-09	1.06E-09	NA	NA	NA	NA
Noncarcinogens						
Acetaldehyde	9.88E-14	1.32E-13	NA	NA	NA	NA
Benzene	2.98E-16	3.97E-16	NA	NA	NA	NA
Ethylbenzene	1.04E-15	1.38E-15	NA	NA	NA	NA
Methyl Chloroform	3.44E-12	4.58E-12	NA	NA	NA	NA
Methylene Chloride	1.44E-15	1.92E-15	NA	NA	NA	NA
Tetrachloroethylene	3.90E-16	5.20E-16	NA	NA	NA	NA
Toluene	7.11E-15	9.47E-15	NA	NA	NA	NA
Vinyl Acetate	2.52E-16	3.36E-16	NA	NA	NA	NA
o-Xylene	2.65E-15	3.51E-15	NA	NA	NA	NA
p-Xylene	8.08E-17	8.10E-17	NA	NA	NA	NA

Table 38a (continued)

Chemical	Subsistence Farmer (mg/kg)	Subsistence Farmer Child (mg/kg)	Subsistence Fisher (mg/kg)	Subsistence Fisher Child (mg/kg)	Adult Resident (mg/kg)	Child Resident (mg/kg)
2-Methylnaphthalene	9.68E-15	1.29E-14	NA	NA	NA	NA
Acenaphthene	8.00E-14	9.57E-14	NA	NA	NA	NA
Acenaphthylene	1.06E-13	1.41E-13	NA	NA	NA	NA
Anthracene	2.36E-12	3.11E-12	NA	NA	NA	NA
Benzo(g,h,i)perylene	NC	NC	NA	NA	NA	NA
Fluoranthene	NC	NC	NA	NA	NA	NA
Fluorene	1.44E-14	1.48E-14	NA	NA	NA	NA
Formaldehyde	2.15E-16	2.87E-16	NA	NA	NA	NA
Manganese	NC	NC	NA	NA	NA	NA
Naphthalene	1.24E-13	1.65E-13	NA	NA	NA	NA
Phenol	2.60E-12	3.46E-12	NA	NA	NA	NA
Pyrene	1.08E-11	1.08E-11	NA	NA	NA	NA
Arsenic	8.03E-09	8.22E-09	NA	NA	NA	NA
Beryllium	1.07E-09	1.06E-09	NA	NA	NA	NA
Cadmium	9.22E-11	1.01E-10	NA	NA	NA	NA
Chlorine	3.49E-07	4.65E-07	NA	NA	NA	NA
Chromium	9.33E-08	8.33E-08	NA	NA	NA	NA
Chromium VI	4.42E-08	4.44E-08	NA	NA	NA	NA
Nickel	4.29E-06	4.38E-06	NA	NA	NA	NA
Selenium	2.65E-09	2.66E-09	NA	NA	NA	NA

NC - Not Calculated NA - Not Available

Table 38b Estimates of Beef Concentrations for the Propane Scenario

Chemical	Subsistence Farmer (mg/kg)	Subsistence Farmer Child (mg/kg)	Subsistence Fisher (mg/kg)	Subsistence Fisher Child (mg/kg)	Adult Resident (mg/kg)	Child Resident (mg/kg)
Carcinogens						
Benzene	2.28E-15	3.04E-15	NA	NA	NA	NA
Formaldehyde	1.59E-15	2.12E-15	NA	NA	NA	NA
Arsenic	4.96E-11	5.02E-11	NA	NA	NA	NA
Noncarcinogens						
Benzene	2.28E-15	3.04E-15	NA	NA	NA	NA
Toluene	6.96E-14	9.26E-14	NA	NA	NA	NA
2-Methylnaphthalene	1.14E-13	1.51E-13	NA	NA	NA	NA
Fluoranthene	5.43E-11	6.67E-11	NA	NA	NA	NA
Fluorene	1.71E-14	1.75E-14	NA	NA	NA	NA
Formaldehyde	1.59E-15	2.12E-15	NA	NA	NA	NA
Naphthalene	1.87E-12	2.49E-12	NA	NA	NA	NA
Pyrene	1.22E-11	1.22E-11	NA	NA	NA	NA
Arsenic	4.96E-11	5.02E-11	NA	NA	NA	NA
Nickel	1.01E-08	1.02E-08	NA	NA	NA	NA

NA - Not Applicable

Table 38c Estimates of Beef Concentrations for the Drill Tower Scenario

Chemical	Subsistence Farmer (mg/kg)	Subsistence Farmer Child (mg/kg)	Subsistence Fisher (mg/kg)	Subsistence Fisher Child (mg/kg)	Adult Resident (mg/kg)	Child Resident (mg/kg)
Carcinogens						
Benzene	4.77E-11	6.36E-11	NA	NA	NA	NA
Benzo(a)pyrene	NC	NC	NA	NA	NA	NA
Benzo[a]anthracene	NC	NC	NA	NA	NA	NA
Benzo[b]flouranthene	NC	NC	NA	NA	NA	NA
Benzo[k]fluoranthene	NC	NC	NA	NA	NA	NA
Chrysene	NC	NC	NA	NA	NA	NA
Dibenz[a,h]anthracene	NC	NC	NA	NA	NA	NA
Indeno[1,2,3-cd]pyrene	NC	NC	NA	NA	NA	NA
Arsenic	1.14E-07	1.15E-07	NA	NA	NA	NA
Chromium VI	1.97E-06	1.98E-06	NA	NA	NA	NA
Noncarcinogens						
Benzaldehyde	1.45E-10	1.94E-10	NA	NA	NA	NA
Benzene	4.77E-11	6.36E-11	NA	NA	NA	NA
Methyl Ethyl Ketone (MEK)	1.97E-12	2.63E-12	NA	NA	NA	NA
Styrene	9.01E-10	1.20E-09	NA	NA	NA	NA
Toluene	7.30E-11	9.71E-11	NA	NA	NA	NA
o-Xylene	1.06E-10	1.40E-10	NA	NA	NA	NA
2-Methylnaphthalene	3.46E-10	4.62E-10	NA	NA	NA	NA
Acenaphthene	NC	NC	NA	NA	NA	NA
Acenaphthylene	NC	NC	NA	NA	NA	NA
Anthracene	NC	NC	NA	NA	NA	NA
Benzo(g,h,i)perylene	NC	NC	NA	NA	NA	NA
Fluoranthene	NC	NC	NA	NA	NA	NA
Fluorene	1.33E-09	1.36E-09	NA	NA	NA	NA

Table 38c (continued)

Chemical	Subsistence Farmer (mg/kg)	Subsistence Farmer Child (mg/kg)	Subsistence Fisher (mg/kg)	Subsistence Fisher Child (mg/kg)	Adult Resident (mg/kg)	Child Resident (mg/kg)
Furans	8.98E-13	1.20E-12	NA	NA	NA	NA
Manganese	NC	NC	NA	NA	NA	NA
Naphthalene	4.94E-08	6.58E-08	NA	NA	NA	NA
Phenol	2.90E-09	3.86E-09	NA	NA	NA	NA
Pyrene	1.13E-06	1.13E-06	NA	NA	NA	NA
n-Hexane	1.27E-12	1.38E-12	NA	NA	NA	NA
Antimony	2.77E-06	2.86E-06	NA	NA	NA	NA
Arsenic	1.14E-07	1.15E-07	NA	NA	NA	NA
Barium	4.18E-05	4.29E-05	NA	NA	NA	NA
Cadmium	6.27E-07	6.71E-07	NA	NA	NA	NA
Chlorine	2.69E-05	3.58E-05	NA	NA	NA	NA
Chromium	3.44E-06	3.14E-06	NA	NA	NA	NA
Chromium VI	1.97E-06	1.98E-06	NA	NA	NA	NA
Nickel	1.65E-06	1.68E-06	NA	NA	NA	NA
Selenium	4.01E-07	4.02E-07	NA	NA	NA	NA
Silver	7.23E-06	7.33E-06	NA	NA	NA	NA
Zinc	4.44E-07	4.65E-07	NA	NA	NA	NA

NC - Not Calculated NA - Not Applicable

Table 39a Estimates of Milk Concentrations for the ARRF Scenario

Chemical	Subsistence Farmer (mg/kg)	Subsistence Farmer Child (mg/kg)	Subsistence Fisher (mg/kg)	Subsistence Fisher Child (mg/kg)	Adult Resident (mg/kg)	Child Resident (mg/kg)
Carcinogens						
Acetaldehyde	5.39E-14	7.19E-14	NA	NA	NA	NA
Benzene	1.61E-16	2.15E-16	NA	NA	NA	NA
Methylene Chloride	7.84E-16	1.04E-15	NA	NA	NA	NA
Tetrachloroethylene	2.09E-16	2.79E-16	NA	NA	NA	NA
Benzo[a]anthracene	NC	NC	NA	NA	NA	NA
Benzo[b]fluoranthene	NC	NC	NA	NA	NA	NA
Chrysene	NC	NC	NA	NA	NA	NA
Dibenz[a,h]anthracene	NC	NC	NA	NA	NA	NA
Formaldehyde	1.17E-16	1.56E-16	NA	NA	NA	NA
Indeno[1,2,3-cd]pyrene	NC	NC	NA	NA	NA	NA
2,3,7,8-TCDDioxin Toxicity Equivalents	3.64E-13	3.63E-13	NA	NA	NA	NA
Arsenic	3.59E-10	3.66E-10	NA	NA	NA	NA
Beryllium	1.27E-12	1.26E-12	NA	NA	NA	NA
Noncarcinogens						
Acetaldehyde	5.39E-14	7.19E-14	NA	NA	NA	NA
Benzene	1.61E-16	2.15E-16	NA	NA	NA	NA
Ethylbenzene	5.44E-16	7.23E-16	NA	NA	NA	NA
Methyl Chloroform	1.85E-12	2.47E-12	NA	NA	NA	NA
Methylene Chloride	7.84E-16	1.04E-15	NA	NA	NA	NA
Tetrachloroethylene	2.09E-16	2.79E-16	NA	NA	NA	NA
Toluene	3.79E-15	5.05E-15	NA	NA	NA	NA
Vinyl Acetate	1.37E-16	1.82E-16	NA	NA	NA	NA
o-Xylene	1.39E-15	1.84E-15	NA	NA	NA	NA
p-Xylene	3.89E-17	3.90E-17	NA	NA	NA	NA

Table 39a (continued)

Chemical	Subsistence Farmer (mg/kg)	Subsistence Farmer Child (mg/kg)	Subsistence Fisher (mg/kg)	Subsistence Fisher Child (mg/kg)	Adult Resident (mg/kg)	Child Resident (mg/kg)
2-Methylnaphthalene	4.90E-14	6.53E-14	NA	NA	NA	NA
Acenaphthene	3.91E-14	4.69E-14	NA	NA	NA	NA
Acenaphthylene	5.26E-13	7.00E-13	NA	NA	NA	NA
Anthracene	1.08E-12	1.42E-12	NA	NA	NA	NA
Benzo(g,h,i)perylene	NC	NC	NA	NA	NA	NA
Fluoranthene	NC	NC	NA	NA	NA	NA
Fluorene	6.93E-15	7.12E-15	NA	NA	NA	NA
Formaldehyde	1.17E-16	1.56E-16	NA	NA	NA	NA
Manganese	NC	NC	NA	NA	NA	NA
Naphthalene	6.42E-14	8.54E-14	NA	NA	NA	NA
Phenol	1.41E-12	1.88E-12	NA	NA	NA	NA
Pyrene	5.19E-12	5.19E-12	NA	NA	NA	NA
Arsenic	3.59E-10	3.66E-10	NA	NA	NA	NA
Beryllium	1.27E-12	1.26E-12	NA	NA	NA	NA
Cadmium	7.75E-12	8.50E-12	NA	NA	NA	NA
Chlorine	5.24E-08	6.98E-08	NA	NA	NA	NA
Chromium	3.07E-08	2.81E-08	NA	NA	NA	NA
Chromium VI	1.81E-08	1.82E-08	NA	NA	NA	NA
Nickel	1.06E-06	1.08E-06	NA	NA	NA	NA
Selenium	1.03E-08	1.03E-08	NA	NA	NA	NA

NC - Not Calculated NA - Not Available

Table 39b Estimates of Milk Concentrations for the Propane Scenario

Chemical	Subsistence Farmer (mg/kg)	Subsistence Farmer Child (mg/kg)	Subsistence Fisher (mg/kg)	Subsistence Fisher Child (mg/kg)	Adult Resident (mg/kg)	Child Resident (mg/kg)
Carcinogens						
Benzene	1.24E-15	1.65E-15	NA	NA	NA	NA
Formaldehyde	8.69E-16	1.16E-15	NA	NA	NA	NA
Arsenic	2.23E-12	2.25E-12	NA	NA	NA	NA
Noncarcinogens						
Benzene	1.24E-15	1.65E-15	NA	NA	NA	NA
Toluene	3.71E-14	4.93E-14	NA	NA	NA	NA
2-Methylnaphthalene	5.75E-13	7.67E-13	NA	NA	NA	NA
Fluoranthene	2.26E-11	2.76E-11	NA	NA	NA	NA
Fluorene	8.20E-15	8.40E-15	NA	NA	NA	NA
Formaldehyde	8.69E-16	1.16E-15	NA	NA	NA	NA
Naphthalene	9.69E-13	1.29E-12	NA	NA	NA	NA
Pyrene	5.87E-12	5.87E-12	NA	NA	NA	NA
Arsenic	2.23E-12	2.25E-12	NA	NA	NA	NA
Nickel	2.50E-09	2.54E-09	NA	NA	NA	NA

NA - Not Applicable

Table 39c Estimates of Milk Concentrations for the Drill Tower Scenario

Chemical	Subsistence Farmer (mg/kg)	Subsistence Farmer Child (mg/kg)	Subsistence Fisher (mg/kg)	Subsistence Fisher Child (mg/kg)	Adult Resident (mg/kg)	Child Resident (mg/kg)
Carcinogens						
Benzene	2.58E-11	3.44E-11	NA	NA	NA	NA
Benzo(a)pyrene	NC	NC	NA	NA	NA	NA
Benzo[a]anthracene	NC	NC	NA	NA	NA	NA
Benzo[b]flouranthene	NC	NC	NA	NA	NA	NA
Benzo[k]fluoranthene	NC	NC	NA	NA	NA	NA
Chrysene	NC	NC	NA	NA	NA	NA
Dibenz[a,h]anthracene	NC	NC	NA	NA	NA	NA
Indeno[1,2,3-cd]pyrene	NC	NC	NA	NA	NA	NA
Arsenic	5.14E-09	5.17E-09	NA	NA	NA	NA
Chromium VI	8.09E-07	8.10E-07	NA	NA	NA	NA
Noncarcinogens						
Benzaldehyde	7.88E-11	1.05E-10	NA	NA	NA	NA
Benzene	2.58E-11	3.44E-11	NA	NA	NA	NA
Methyl Ethyl Ketone (MEK)	1.07E-12	1.43E-12	NA	NA	NA	NA
Styrene	4.78E-10	6.37E-10	NA	NA	NA	NA
Toluene	3.89E-11	5.17E-11	NA	NA	NA	NA
o-Xylene	5.54E-11	7.35E-11	NA	NA	NA	NA
2-Methylnaphthalene	1.75E-09	2.34E-09	NA	NA	NA	NA
Acenaphthene	NC	NC	NA	NA	NA	NA
Acenaphthylene	NC	NC	NA	NA	NA	NA
Anthracene	NC	NC	NA	NA	NA	NA
Benzo(g,h,i)perylene	NC	NC	NA	NA	NA	NA
Fluoranthene	NC	NC	NA	NA	NA	NA
Fluorene	6.36E-10	6.52E-10	NA	NA	NA	NA

Table 39c (continued)

Chemical	Subsistence Farmer (mg/kg)	Subsistence Farmer Child (mg/kg)	Subsistence Fisher (mg/kg)	Subsistence Fisher Child (mg/kg)	Adult Resident (mg/kg)	Child Resident (mg/kg)
Furans	4.88E-13	6.50E-13	NA	NA	NA	NA
Manganese	NC	NC	NA	NA	NA	NA
Naphthalene	2.56E-08	3.41E-08	NA	NA	NA	NA
Phenol	1.57E-09	2.09E-09	NA	NA	NA	NA
Pyrene	5.44E-07	5.44E-07	NA	NA	NA	NA
n-Hexane	6.23E-13	6.84E-13	NA	NA	NA	NA
Antimony	4.20E-07	4.34E-07	NA	NA	NA	NA
Arsenic	5.14E-09	5.17E-09	NA	NA	NA	NA
Barium	1.48E-04	1.51E-04	NA	NA	NA	NA
Cadmium	5.24E-08	5.62E-08	NA	NA	NA	NA
Chlorine	4.03E-06	5.37E-06	NA	NA	NA	NA
Chromium	1.18E-06	1.11E-06	NA	NA	NA	NA
Chromium VI	8.09E-07	8.10E-07	NA	NA	NA	NA
Nickel	4.12E-07	4.17E-07	NA	NA	NA	NA
Selenium	1.56E-06	1.57E-06	NA	NA	NA	NA
Silver	7.31E-05	7.41E-05	NA	NA	NA	NA
Zinc	2.44E-07	2.57E-07	NA	NA	NA	NA

NC - Not Calculated NA - Not Applicable

Table 40a Estimates of Pork Concentrations for the ARRF Scenario

Chemical	Subsistence Farmer (mg/kg)	Subsistence Farmer Child (mg/kg)	Subsistence Fisher (mg/kg)	Subsistence Fisher Child (mg/kg)	Adult Resident (mg/kg)	Child Resident (mg/kg)
Carcinogens						
Acetaldehyde	4.78E-12	6.38E-12	NA	NA	NA	NA
Benzene	1.46E-16	1.95E-16	NA	NA	NA	NA
Methylene Chloride	6.99E-16	9.33E-16	NA	NA	NA	NA
Tetrachloroethylene	1.94E-16	2.58E-16	NA	NA	NA	NA
Benzo[a]anthracene	NC	NC	NA	NA	NA	NA
Benzo[b]fluoranthene	NC	NC	NA	NA	NA	NA
Chrysene	NC	NC	NA	NA	NA	NA
Dibenz[a,h]anthracene	NC	NC	NA	NA	NA	NA
Formaldehyde	1.04E-16	1.39E-16	NA	NA	NA	NA
Indeno[1,2,3-cd]pyrene	NC	NC	NA	NA	NA	NA
2,3,7,8-TCDDioxin Toxicity Equivalents	3.61E-13	3.56E-13	NA	NA	NA	NA
Arsenic	NC	NC	NA	NA	NA	NA
Beryllium	NC	NC	NA	NA	NA	NA
Noncarcinogens						
Acetaldehyde	4.78E-12	6.38E-12	NA	NA	NA	NA
Benzene	1.46E-16	1.95E-16	NA	NA	NA	NA
Ethylbenzene	5.22E-16	6.95E-16	NA	NA	NA	NA
Methyl Chloroform	1.70E-12	2.27E-12	NA	NA	NA	NA
Methylene Chloride	6.99E-16	9.33E-16	NA	NA	NA	NA
Tetrachloroethylene	1.94E-16	2.58E-16	NA	NA	NA	NA
Toluene	3.51E-15	4.68E-15	NA	NA	NA	NA
Vinyl Acetate	1.22E-16	1.62E-16	NA	NA	NA	NA
o-Xylene	1.33E-15	1.77E-15	NA	NA	NA	NA
p-Xylene	7.05E-18	7.15E-18	NA	NA	NA	NA

Table 40a (continued)

Chemical	Subsistence Farmer (mg/kg)	Subsistence Farmer Child (mg/kg)	Subsistence Fisher (mg/kg)	Subsistence Fisher Child (mg/kg)	Adult Resident (mg/kg)	Child Resident (mg/kg)
2-Methylnaphthalene	1.63E-14	2.17E-14	NA	NA	NA	NA
Acenaphthene	2.89E-14	3.76E-14	NA	NA	NA	NA
Acenaphthylene	1.85E-13	2.46E-13	NA	NA	NA	NA
Anthracene	1.42E-12	1.87E-12	NA	NA	NA	NA
Benzo(g,h,i)perylene	NC	NC	NA	NA	NA	NA
Fluoranthene	NC	NC	NA	NA	NA	NA
Fluorene	1.78E-15	2.00E-15	NA	NA	NA	NA
Formaldehyde	1.04E-16	1.39E-16	NA	NA	NA	NA
Manganese	NC	NC	NA	NA	NA	NA
Naphthalene	6.40E-14	8.53E-14	NA	NA	NA	NA
Phenol	1.26E-12	1.68E-12	NA	NA	NA	NA
Pyrene	9.06E-13	9.06E-13	NA	NA	NA	NA
Arsenic	NC	NC	NA	NA	NA	NA
Beryllium	NC	NC	NA	NA	NA	NA
Cadmium	2.59E-11	3.18E-11	NA	NA	NA	NA
Chlorine	NC	NC	NA	NA	NA	NA
Chromium	NC	NC	NA	NA	NA	NA
Chromium VI	NC	NC	NA	NA	NA	NA
Nickel	NC	NC	NA	NA	NA	NA
Selenium	1.09E-08	1.14E-08	NA	NA	NA	NA

NC - Not Calculated NA - Not Available

Table 40b Estimates of Pork Concentrations for the Propane Scenario

Chemical	Subsistence Farmer (mg/kg)	Subsistence Farmer Child (mg/kg)	Subsistence Fisher (mg/kg)	Subsistence Fisher Child (mg/kg)	Adult Resident (mg/kg)	Child Resident (mg/kg)
Carcinogens						
Benzene	1.12E-15	1.49E-15	NA	NA	NA	NA
Formaldehyde	7.71E-16	1.03E-15	NA	NA	NA	NA
Arsenic	NC	NC	NA	NA	NA	NA
Noncarcinogens						
Benzene	1.12E-15	1.49E-15	NA	NA	NA	NA
Toluene	3.43E-14	4.57E-14	NA	NA	NA	NA
2-Methylnaphthalene	1.91E-13	2.55E-13	NA	NA	NA	NA
Fluoranthene	3.14E-11	3.98E-11	NA	NA	NA	NA
Fluorene	2.06E-15	2.30E-15	NA	NA	NA	NA
Formaldehyde	7.71E-16	1.03E-15	NA	NA	NA	NA
Naphthalene	9.66E-13	1.29E-12	NA	NA	NA	NA
Pyrene	1.03E-12	1.03E-12	NA	NA	NA	NA
Arsenic	NC	NC	NA	NA	NA	NA
Nickel	NC	NC	NA	NA	NA	NA

NC - Not Calculated   NA - Not Applicable

Table 40c Estimates of Pork Concentrations for the Drill Tower Scenario

Chemical	Subsistence Farmer (mg/kg)	Subsistence Farmer Child (mg/kg)	Subsistence Fisher (mg/kg)	Subsistence Fisher Child (mg/kg)	Adult Resident (mg/kg)	Child Resident (mg/kg)
Carcinogens						
Benzene	2.34E-11	3.12E-11	NA	NA	NA	NA
Benzo(a)pyrene	NC	NC	NA	NA	NA	NA
Benzo[a]anthracene	NC	NC	NA	NA	NA	NA
Benzo[b]flouranthene	NC	NC	NA	NA	NA	NA
Benzo[k]fluoranthene	NC	NC	NA	NA	NA	NA
Chrysene	NC	NC	NA	NA	NA	NA
Dibenz[a,h]anthracene	NC	NC	NA	NA	NA	NA
Indeno[1,2,3-cd]pyrene	NC	NC	NA	NA	NA	NA
Arsenic	NC	NC	NA	NA	NA	NA
Chromium VI	NC	NC	NA	NA	NA	NA
Noncarcinogens						
Benzaldehyde	7.06E-11	9.42E-11	NA	NA	NA	NA
Benzene	2.34E-11	3.12E-11	NA	NA	NA	NA
Methyl Ethyl Ketone (MEK)	9.53E-13	1.27E-12	NA	NA	NA	NA
Styrene	4.54E-10	6.05E-10	NA	NA	NA	NA
Toluene	3.60E-11	4.80E-11	NA	NA	NA	NA
o-Xylene	5.31E-11	7.07E-11	NA	NA	NA	NA
2-Methylnaphthalene	5.84E-10	7.78E-10	NA	NA	NA	NA
Acenaphthene	NC	NC	NA	NA	NA	NA
Acenaphthylene	NC	NC	NA	NA	NA	NA
Anthracene	NC	NC	NA	NA	NA	NA
Benzo(g,h,i)perylene	NC	NC	NA	NA	NA	NA
Fluoranthene	NC	NC	NA	NA	NA	NA
Fluorene	1.55E-10	1.74E-10	NA	NA	NA	NA

Table 40c (continued)

Chemical	Subsistence Farmer (mg/kg)	Subsistence Farmer Child (mg/kg)	Subsistence Fisher (mg/kg)	Subsistence Fisher Child (mg/kg)	Adult Resident (mg/kg)	Child Resident (mg/kg)
Furans	4.31E-13	5.75E-13	NA	NA	NA	NA
Manganese	NC	NC	NA	NA	NA	NA
Naphthalene	2.55E-08	3.40E-08	NA	NA	NA	NA
Phenol	1.41E-09	1.87E-09	NA	NA	NA	NA
Pyrene	9.36E-08	9.36E-08	NA	NA	NA	NA
n-Hexane	2.56E-13	3.15E-13	NA	NA	NA	NA
Antimony	NC	NC	NA	NA	NA	NA
Arsenic	NC	NC	NA	NA	NA	NA
Barium	NC	NC	NA	NA	NA	NA
Cadmium	1.43E-07	1.73E-07	NA	NA	NA	NA
Chlorine	NC	NC	NA	NA	NA	NA
Chromium	NC	NC	NA	NA	NA	NA
Chromium VI	NC	NC	NA	NA	NA	NA
Nickel	NC	NC	NA	NA	NA	NA
Selenium	1.51E-06	1.53E-06	NA	NA	NA	NA
Silver	NC	NC	NA	NA	NA	NA
Zinc	7.07E-08	8.42E-08	NA	NA	NA	NA

NC - Not Calculated   NA - Not Applicable

Table 41a Estimates of Poultry Concentrations for the ARRF Scenario

Chemical	Subsistence Farmer (mg/kg)	Subsistence Farmer Child (mg/kg)	Subsistence Fisher (mg/kg)	Subsistence Fisher Child (mg/kg)	Adult Resident (mg/kg)	Child Resident (mg/kg)
Carcinogens						
Acetaldehyde	1.32E-15	1.77E-15	NA	NA	NA	NA
Benzene	4.11E-18	5.48E-18	NA	NA	NA	NA
Methylene Chloride	1.95E-17	2.60E-17	NA	NA	NA	NA
Tetrachloroethylene	5.48E-18	7.31E-18	NA	NA	NA	NA
Benzo[a]anthracene	NC	NC	NA	NA	NA	NA
Benzo[b]fluoranthene	NC	NC	NA	NA	NA	NA
Chrysene	NC	NC	NA	NA	NA	NA
Dibenz[a,h]anthracene	NC	NC	NA	NA	NA	NA
Formaldehyde	2.89E-18	3.85E-18	NA	NA	NA	NA
Indeno[1,2,3-cd]pyrene	NC	NC	NA	NA	NA	NA
2,3,7,8-TCDDioxin Toxicity Equivalents	3.75E-12	3.68E-12	NA	NA	NA	NA
Arsenic	NC	NC	NA	NA	NA	NA
Beryllium	NC	NC	NA	NA	NA	NA
Noncarcinogens						
Acetaldehyde	1.32E-15	1.77E-15	NA	NA	NA	NA
Benzene	4.11E-18	5.48E-18	NA	NA	NA	NA
Ethylbenzene	1.51E-17	2.01E-17	NA	NA	NA	NA
Methyl Chloroform	4.81E-14	6.42E-14	NA	NA	NA	NA
Methylene Chloride	1.95E-17	2.60E-17	NA	NA	NA	NA
Tetrachloroethylene	5.48E-18	7.31E-18	NA	NA	NA	NA
Toluene	1.00E-16	1.34E-16	NA	NA	NA	NA
Vinyl Acetate	3.38E-18	4.51E-18	NA	NA	NA	NA
o-Xylene	3.86E-17	5.15E-17	NA	NA	NA	NA
p-Xylene	8.62E-21	1.15E-20	NA	NA	NA	NA

Table 41a (continued)

Chemical	Subsistence Farmer (mg/kg)	Subsistence Farmer Child (mg/kg)	Subsistence Fisher (mg/kg)	Subsistence Fisher Child (mg/kg)	Adult Resident (mg/kg)	Child Resident (mg/kg)
2-Methylnaphthalene	1.99E-13	2.66E-13	NA	NA	NA	NA
Acenaphthene	8.09E-16	1.08E-15	NA	NA	NA	NA
Acenaphthylene	2.30E-12	3.06E-12	NA	NA	NA	NA
Anthracene	4.60E-14	6.08E-14	NA	NA	NA	NA
Benzo(g,h,i)perylene	NC	NC	NA	NA	NA	NA
Fluoranthene	NC	NC	NA	NA	NA	NA
Fluorene	2.10E-17	2.81E-17	NA	NA	NA	NA
Formaldehyde	2.89E-18	3.85E-18	NA	NA	NA	NA
Manganese	NC	NC	NA	NA	NA	NA
Naphthalene	1.88E-15	2.51E-15	NA	NA	NA	NA
Phenol	3.52E-14	4.69E-14	NA	NA	NA	NA
Pyrene	2.55E-17	3.41E-17	NA	NA	NA	NA
Arsenic	NC	NC	NA	NA	NA	NA
Beryllium	NC	NC	NA	NA	NA	NA
Cadmium	5.48E-10	6.97E-10	NA	NA	NA	NA
Chlorine	NC	NC	NA	NA	NA	NA
Chromium	NC	NC	NA	NA	NA	NA
Chromium VI	NC	NC	NA	NA	NA	NA
Nickel	NC	NC	NA	NA	NA	NA
Selenium	5.05E-10	6.72E-10	NA	NA	NA	NA

NC - Not Calculated NA - Not Available

Table 41b Estimates of Poultry Concentrations for the Propane Scenario

Chemical	Subsistence Farmer (mg/kg)	Subsistence Farmer Child (mg/kg)	Subsistence Fisher (mg/kg)	Subsistence Fisher Child (mg/kg)	Adult Resident (mg/kg)	Child Resident (mg/kg)
Carcinogens						
Benzene	3.15E-17	4.20E-17	NA	NA	NA	NA
Formaldehyde	2.14E-17	2.85E-17	NA	NA	NA	NA
Arsenic	NC	NC	NA	NA	NA	NA
Noncarcinogens						
Benzene	3.15E-17	4.20E-17	NA	NA	NA	NA
Toluene	9.79E-16	1.31E-15	NA	NA	NA	NA
2-Methylnaphthalene	2.34E-12	3.12E-12	NA	NA	NA	NA
Fluoranthene	1.06E-12	1.36E-12	NA	NA	NA	NA
Fluorene	2.30E-17	3.07E-17	NA	NA	NA	NA
Formaldehyde	2.14E-17	2.85E-17	NA	NA	NA	NA
Naphthalene	2.84E-14	3.79E-14	NA	NA	NA	NA
Pyrene	2.65E-17	3.53E-17	NA	NA	NA	NA
Arsenic	NC	NC	NA	NA	NA	NA
Nickel	NC	NC	NA	NA	NA	NA

NC - Not Calculated   NA - Not Applicable

Table 41c Estimates of Poultry Concentrations for the Drill Tower Scenario

Chemical	Subsistence Farmer (mg/kg)	Subsistence Farmer Child (mg/kg)	Subsistence Fisher (mg/kg)	Subsistence Fisher Child (mg/kg)	Adult Resident (mg/kg)	Child Resident (mg/kg)
Carcinogens						
Benzene	6.58E-13	8.77E-13	NA	NA	NA	NA
Benzo(a)pyrene	NC	NC	NA	NA	NA	NA
Benzo[a]anthracene	NC	NC	NA	NA	NA	NA
Benzo[b]flouranthene	NC	NC	NA	NA	NA	NA
Benzo[k]fluoranthene	NC	NC	NA	NA	NA	NA
Chrysene	NC	NC	NA	NA	NA	NA
Dibenz[a,h]anthracene	NC	NC	NA	NA	NA	NA
Indeno[1,2,3-cd]pyrene	NC	NC	NA	NA	NA	NA
Arsenic	NC	NC	NA	NA	NA	NA
Chromium VI	NC	NC	NA	NA	NA	NA
Noncarcinogens						
Benzaldehyde	1.97E-12	2.63E-12	NA	NA	NA	NA
Benzene	6.58E-13	8.77E-13	NA	NA	NA	NA
Methyl Ethyl Ketone (MEK)	2.65E-14	3.53E-14	NA	NA	NA	NA
Styrene	1.30E-11	1.74E-11	NA	NA	NA	NA
Toluene	1.03E-12	1.37E-12	NA	NA	NA	NA
o-Xylene	1.54E-12	2.05E-12	NA	NA	NA	NA
2-Methylnaphthalene	7.14E-09	9.52E-09	NA	NA	NA	NA
Acenaphthene	NC	NC	NA	NA	NA	NA
Acenaphthylene	NC	NC	NA	NA	NA	NA
Anthracene	NC	NC	NA	NA	NA	NA
Benzo(g,h,i)perylene	NC	NC	NA	NA	NA	NA
Fluoranthene	NC	NC	NA	NA	NA	NA
Fluorene	1.72E-12	2.29E-12	NA	NA	NA	NA

Table 41c (continued)

Chemical	Subsistence Farmer (mg/kg)	Subsistence Farmer Child (mg/kg)	Subsistence Fisher (mg/kg)	Subsistence Fisher Child (mg/kg)	Adult Resident (mg/kg)	Child Resident (mg/kg)
Furans	4.85E-12	6.47E-12	NA	NA	NA	NA
Manganese	NC	NC	NA	NA	NA	NA
Naphthalene	7.51E-10	1.00E-09	NA	NA	NA	NA
Phenol	3.92E-11	5.23E-11	NA	NA	NA	NA
Pyrene	2.37E-12	3.16E-12	NA	NA	NA	NA
n-Hexane	2.12E-12	2.83E-12	NA	NA	NA	NA
Antimony	NC	NC	NA	NA	NA	NA
Arsenic	NC	NC	NA	NA	NA	NA
Barium	NC	NC	NA	NA	NA	NA
Cadmium	2.80E-06	3.56E-06	NA	NA	NA	NA
Chlorine	NC	NC	NA	NA	NA	NA
Chromium	NC	NC	NA	NA	NA	NA
Chromium VI	NC	NC	NA	NA	NA	NA
Nickel	NC	NC	NA	NA	NA	NA
Selenium	2.48E-08	3.30E-08	NA	NA	NA	NA
Silver	NC	NC	NA	NA	NA	NA
Zinc	1.53E-07	1.96E-07	NA	NA	NA	NA

NC - Not Calculated NA - Not Applicable

Table 42a Estimates of Egg Concentrations for the ARRF Scenario

Chemical	Subsistence Farmer (mg/kg)	Subsistence Farmer Child (mg/kg)	Subsistence Fisher (mg/kg)	Subsistence Fisher Child (mg/kg)	Adult Resident (mg/kg)	Child Resident (mg/kg)
Carcinogens						
Acetaldehyde	5.32E-13	7.09E-13	NA	NA	NA	NA
Benzene	1.65E-15	2.20E-15	NA	NA	NA	NA
Methylene Chloride	7.81E-15	1.04E-14	NA	NA	NA	NA
Tetrachloroethylene	2.20E-15	2.93E-15	NA	NA	NA	NA
Benzo[a]anthracene	NC	NC	NA	NA	NA	NA
Benzo[b]fluoranthene	NC	NC	NA	NA	NA	NA
Chrysene	NC	NC	NA	NA	NA	NA
Dibenz[a,h]anthracene	NC	NC	NA	NA	NA	NA
Formaldehyde	1.16E-15	1.54E-15	NA	NA	NA	NA
Indeno[1,2,3-cd]pyrene	NC	NC	NA	NA	NA	NA
2,3,7,8-TCDDioxin Toxicity Equivalents	3.13E-12	3.07E-12	NA	NA	NA	NA
Arsenic	NC	NC	NA	NA	NA	NA
Beryllium	NC	NC	NA	NA	NA	NA
Noncarcinogens						
Acetaldehyde	5.32E-13	7.09E-13	NA	NA	NA	NA
Benzene	1.65E-15	2.20E-15	NA	NA	NA	NA
Ethylbenzene	6.03E-15	8.04E-15	NA	NA	NA	NA
Methyl Chloroform	1.93E-11	2.57E-11	NA	NA	NA	NA
Methylene Chloride	7.81E-15	1.04E-14	NA	NA	NA	NA
Tetrachloroethylene	2.20E-15	2.93E-15	NA	NA	NA	NA
Toluene	4.01E-14	5.35E-14	NA	NA	NA	NA
Vinyl Acetate	1.35E-15	1.81E-15	NA	NA	NA	NA
o-Xylene	1.54E-14	2.06E-14	NA	NA	NA	NA
p-Xylene	3.47E-18	4.63E-18	NA	NA	NA	NA

Table 42a (continued)

Chemical	Subsistence Farmer (mg/kg)	Subsistence Farmer Child (mg/kg)	Subsistence Fisher (mg/kg)	Subsistence Fisher Child (mg/kg)	Adult Resident (mg/kg)	Child Resident (mg/kg)
2-Methylnaphthalene	1.99E-13	2.66E-13	NA	NA	NA	NA
Acenaphthene	3.24E-13	4.31E-13	NA	NA	NA	NA
Acenaphthylene	2.30E-12	3.06E-12	NA	NA	NA	NA
Anthracene	1.84E-11	2.43E-11	NA	NA	NA	NA
Benzo(g,h,i)perylene	NC	NC	NA	NA	NA	NA
Fluoranthene	NC	NC	NA	NA	NA	NA
Fluorene	8.43E-15	1.12E-14	NA	NA	NA	NA
Formaldehyde	1.16E-15	1.54E-15	NA	NA	NA	NA
Manganese	NC	NC	NA	NA	NA	NA
Naphthalene	7.54E-13	1.00E-12	NA	NA	NA	NA
Phenol	1.41E-11	1.88E-11	NA	NA	NA	NA
Pyrene	1.02E-14	1.37E-14	NA	NA	NA	NA
Arsenic	NC	NC	NA	NA	NA	NA
Beryllium	NC	NC	NA	NA	NA	NA
Cadmium	1.29E-11	1.64E-11	NA	NA	NA	NA
Chlorine	NC	NC	NA	NA	NA	NA
Chromium	NC	NC	NA	NA	NA	NA
Chromium VI	NC	NC	NA	NA	NA	NA
Nickel	NC	NC	NA	NA	NA	NA
Selenium	5.05E-10	6.72E-10	NA	NA	NA	NA

NC - Not Calculated NA - Not Available

Table 42b Estimates of Egg Concentrations for the Propane Scenario

Chemical	Subsistence Farmer (mg/kg)	Subsistence Farmer Child (mg/kg)	Subsistence Fisher (mg/kg)	Subsistence Fisher Child (mg/kg)	Adult Resident (mg/kg)	Child Resident (mg/kg)
Carcinogens						
Benzene	1.26E-14	1.68E-14	NA	NA	NA	NA
Formaldehyde	8.59E-15	1.15E-14	NA	NA	NA	NA
Arsenic	NC	NC	NA	NA	NA	NA
Noncarcinogens						
Benzene	1.26E-14	1.68E-14	NA	NA	NA	NA
Toluene	3.92E-13	5.22E-13	NA	NA	NA	NA
2-Methylnaphthalene	2.34E-12	3.12E-12	NA	NA	NA	NA
Fluoranthene	4.26E-10	5.44E-10	NA	NA	NA	NA
Fluorene	9.22E-15	1.23E-14	NA	NA	NA	NA
Formaldehyde	8.59E-15	1.15E-14	NA	NA	NA	NA
Naphthalene	1.14E-11	1.52E-11	NA	NA	NA	NA
Pyrene	1.06E-14	1.41E-14	NA	NA	NA	NA
Arsenic	NC	NC	NA	NA	NA	NA
Nickel	NC	NC	NA	NA	NA	NA

NC - Not Calculated NA - Not Applicable

Table 42c Estimates of Egg Concentrations for the Drill Tower Scenario

Chemical	Subsistence Farmer (mg/kg)	Subsistence Farmer Child (mg/kg)	Subsistence Fisher (mg/kg)	Subsistence Fisher Child (mg/kg)	Adult Resident (mg/kg)	Child Resident (mg/kg)
Carcinogens						
Benzene	2.64E-10	3.52E-10	NA	NA	NA	NA
Benzo(a)pyrene	NC	NC	NA	NA	NA	NA
Benzo[a]anthracene	NC	NC	NA	NA	NA	NA
Benzo[b]flouranthene	NC	NC	NA	NA	NA	NA
Benzo[k]fluoranthene	NC	NC	NA	NA	NA	NA
Chrysene	NC	NC	NA	NA	NA	NA
Dibenz[a,h]anthracene	NC	NC	NA	NA	NA	NA
Indeno[1,2,3-cd]pyrene	NC	NC	NA	NA	NA	NA
Arsenic	NC	NC	NA	NA	NA	NA
Chromium VI	NC	NC	NA	NA	NA	NA
Noncarcinogens						
Benzaldehyde	7.89E-10	1.05E-09	NA	NA	NA	NA
Benzene	2.64E-10	3.52E-10	NA	NA	NA	NA
Methyl Ethyl Ketone (MEK)	1.06E-11	1.41E-11	NA	NA	NA	NA
Styrene	5.23E-09	6.97E-09	NA	NA	NA	NA
Toluene	4.11E-10	5.48E-10	NA	NA	NA	NA
o-Xylene	6.14E-10	8.19E-10	NA	NA	NA	NA
2-Methylnaphthalene	7.14E-09	9.52E-09	NA	NA	NA	NA
Acenaphthene	NC	NC	NA	NA	NA	NA
Acenaphthylene	NC	NC	NA	NA	NA	NA
Anthracene	NC	NC	NA	NA	NA	NA
Benzo(g,h,i)perylene	NC	NC	NA	NA	NA	NA
Fluoranthene	NC	NC	NA	NA	NA	NA
Fluorene	6.88E-10	9.17E-10	NA	NA	NA	NA

Table 42c (continued)

Chemical	Subsistence Farmer (mg/kg)	Subsistence Farmer Child (mg/kg)	Subsistence Fisher (mg/kg)	Subsistence Fisher Child (mg/kg)	Adult Resident (mg/kg)	Child Resident (mg/kg)
Furans	4.85E-12	6.47E-12	NA	NA	NA	NA
Manganese	NC	NC	NA	NA	NA	NA
Naphthalene	3.01E-07	4.01E-07	NA	NA	NA	NA
Phenol	1.57E-08	2.09E-08	NA	NA	NA	NA
Pyrene	9.52E-10	1.27E-09	NA	NA	NA	NA
n-Hexane	2.12E-12	2.83E-12	NA	NA	NA	NA
Antimony	NC	NC	NA	NA	NA	NA
Arsenic	NC	NC	NA	NA	NA	NA
Barium	NC	NC	NA	NA	NA	NA
Cadmium	6.60E-08	8.40E-08	NA	NA	NA	NA
Chlorine	NC	NC	NA	NA	NA	NA
Chromium	NC	NC	NA	NA	NA	NA
Chromium VI	NC	NC	NA	NA	NA	NA
Nickel	NC	NC	NA	NA	NA	NA
Selenium	2.48E-08	3.30E-08	NA	NA	NA	NA
Silver	NC	NC	NA	NA	NA	NA
Zinc	1.53E-07	1.96E-07	NA	NA	NA	NA

NC - Not Calculated NA - Not Applicable

Table 43a Estimates of Water Concentrations for the ARRF Scenario

Chemical	Subsistence Farmer (mg/kg)	Subsistence Farmer Child (mg/kg)	Subsistence Fisher (mg/kg)	Subsistence Fisher Child (mg/kg)	Adult Resident (mg/kg)	Child Resident (mg/kg)
Carcinogens						
Acetaldehyde	3.22E-06	4.27E-06	4.27E-06	4.27E-06	4.27E-06	4.27E-06
Benzene	8.17E-15	8.17E-15	8.17E-15	8.17E-15	8.17E-15	8.17E-15
Methylene Chloride	4.31E-13	4.32E-13	4.32E-13	4.32E-13	4.32E-13	4.32E-13
Tetrachloroethylene	1.01E-15	1.01E-15	1.01E-15	1.01E-15	1.01E-15	1.01E-15
Benzo[a]anthracene	3.82E-13	4.25E-13	4.25E-13	4.25E-13	4.25E-13	4.25E-13
Benzo[b]fluoranthene	1.93E-13	2.13E-13	2.13E-13	2.13E-13	2.13E-13	2.13E-13
Chrysene	6.19E-13	6.85E-13	6.85E-13	6.85E-13	6.85E-13	6.85E-13
Dibenz[a,h]anthracene	8.20E-15	9.41E-15	9.41E-15	9.41E-15	9.41E-15	9.41E-15
Formaldehyde	3.67E-12	3.67E-12	3.67E-12	3.67E-12	3.67E-12	3.67E-12
Indeno[1,2,3-cd]pyrene	8.20E-15	9.60E-15	9.60E-15	9.60E-15	9.60E-15	9.60E-15
2,3,7,8-TCDDioxin Toxicity Equivalents	2.42E-17	2.38E-17	2.38E-17	2.38E-17	2.38E-17	2.38E-17
Arsenic	1.62E-08	2.01E-08	2.01E-08	2.01E-08	2.01E-08	2.01E-08
Beryllium	1.46E-10	1.43E-10	1.43E-10	1.43E-10	1.43E-10	1.43E-10
Noncarcinogens						
Acetaldehyde	3.22E-06	4.27E-06	4.27E-06	4.27E-06	4.27E-06	4.27E-06
Benzene	8.17E-15	8.17E-15	8.17E-15	8.17E-15	8.17E-15	8.17E-15
Ethylbenzene	2.02E-15	2.02E-15	2.02E-15	2.02E-15	2.02E-15	2.02E-15
Methyl Chloroform	1.29E-14	1.29E-14	1.29E-14	1.29E-14	1.29E-14	1.29E-14
Methylene Chloride	4.31E-13	4.32E-13	4.32E-13	4.32E-13	4.32E-13	4.32E-13
Tetrachloroethylene	1.01E-15	1.01E-15	1.01E-15	1.01E-15	1.01E-15	1.01E-15
Toluene	4.17E-14	4.17E-14	4.17E-14	4.17E-14	4.17E-14	4.17E-14
Vinyl Acetate	2.99E-13	2.99E-13	2.99E-13	2.99E-13	2.99E-13	2.99E-13
o-Xylene	4.41E-15	4.41E-15	4.41E-15	4.41E-15	4.41E-15	4.41E-15
p-Xylene	1.00E-13	1.00E-13	1.00E-13	1.00E-13	1.00E-13	1.00E-13

Table 43a (continued)

Chemical	Subsistence Farmer (mg/kg)	Subsistence Farmer Child (mg/kg)	Subsistence Fisher (mg/kg)	Subsistence Fisher Child (mg/kg)	Adult Resident (mg/kg)	Child Resident (mg/kg)
2-Methylnaphthalene	1.22E-15	1.23E-15	1.23E-15	1.23E-15	1.23E-15	1.23E-15
Acenaphthene	6.13E-14	6.13E-14	6.13E-14	6.13E-14	6.13E-14	6.13E-14
Acenaphthylene	5.02E-15	5.13E-15	5.13E-15	5.13E-15	5.13E-15	5.13E-15
Anthracene	4.85E-15	5.06E-15	5.06E-15	5.06E-15	5.06E-15	5.06E-15
Benzo(g,h,i)perylene	2.08E-13	1.70E-13	1.70E-13	1.70E-13	1.70E-13	1.70E-13
Fluoranthene	8.35E-14	9.21E-14	9.21E-14	9.21E-14	9.21E-14	9.21E-14
Fluorene	9.05E-15	9.05E-15	9.05E-15	9.05E-15	9.05E-15	9.05E-15
Formaldehyde	3.67E-12	3.67E-12	3.67E-12	3.67E-12	3.67E-12	3.67E-12
Manganese	NC	NC	NC	NC	NC	NC
Naphthalene	2.25E-14	2.25E-14	2.25E-14	2.25E-14	2.25E-14	2.25E-14
Phenol	2.30E-09	2.63E-09	2.63E-09	2.63E-09	2.63E-09	2.63E-09
Pyrene	1.36E-13	1.36E-13	1.36E-13	1.36E-13	1.36E-13	1.36E-13
Arsenic	1.62E-08	2.01E-08	2.01E-08	2.01E-08	2.01E-08	2.01E-08
Beryllium	1.46E-10	1.43E-10	1.43E-10	1.43E-10	1.43E-10	1.43E-10
Cadmium	4.75E-10	5.79E-10	5.79E-10	5.79E-10	5.79E-10	5.79E-10
Chlorine	2.99E-03	3.97E-03	3.97E-03	3.97E-03	3.97E-03	3.97E-03
Chromium	1.22E-12	9.88E-13	9.88E-13	9.88E-13	9.88E-13	9.88E-13
Chromium VI	2.41E-08	3.00E-08	3.00E-08	3.00E-08	3.00E-08	3.00E-08
Nickel	6.92E-07	8.47E-07	8.47E-07	8.47E-07	8.47E-07	8.47E-07
Selenium	2.46E-08	3.08E-08	3.08E-08	3.08E-08	3.08E-08	3.08E-08

NC - Not Calculated

Table 43b Estimates of Water Concentrations for the Propane Scenario

Chemical	Subsistence Farmer (mg/kg)	Subsistence Farmer Child (mg/kg)	Subsistence Fisher (mg/kg)	Subsistence Fisher Child (mg/kg)	Adult Resident (mg/kg)	Child Resident (mg/kg)
Carcinogens						
Benzene	1.17E-13	1.17E-13	1.17E-13	1.17E-13	1.17E-13	1.17E-13
Formaldehyde	4.87E-11	4.87E-11	4.87E-11	4.87E-11	4.87E-11	4.87E-11
Arsenic	9.29E-11	1.15E-10	1.15E-10	1.15E-10	1.15E-10	1.15E-10
Noncarcinogens						
Benzene	1.17E-13	1.17E-13	1.17E-13	1.17E-13	1.17E-13	1.17E-13
Toluene	7.62E-13	7.62E-13	7.62E-13	7.62E-13	7.62E-13	7.62E-13
2-Methylnaphthalene	2.71E-14	2.72E-14	2.72E-14	2.72E-14	2.72E-14	2.72E-14
Fluoranthene	2.23E-13	2.46E-13	2.46E-13	2.46E-13	2.46E-13	2.46E-13
Fluorene	1.87E-14	1.87E-14	1.87E-14	1.87E-14	1.87E-14	1.87E-14
Formaldehyde	4.87E-11	4.87E-11	4.87E-11	4.87E-11	4.87E-11	4.87E-11
Naphthalene	6.40E-13	6.41E-13	6.41E-13	6.41E-13	6.41E-13	6.41E-13
Pyrene	2.68E-13	2.68E-13	2.68E-13	2.68E-13	2.68E-13	2.68E-13
Arsenic	9.29E-11	1.15E-10	1.15E-10	1.15E-10	1.15E-10	1.15E-10
Nickel	2.42E-09	2.97E-09	2.97E-09	2.97E-09	2.97E-09	2.97E-09

Table 43c Estimates of Water Concentrations for the Drill Tower Scenario

Chemical	Subsistence Farmer (mg/kg)	Subsistence Farmer Child (mg/kg)	Subsistence Fisher (mg/kg)	Subsistence Fisher Child (mg/kg)	Adult Resident (mg/kg)	Child Resident (mg/kg)
Carcinogens						
Benzene	6.58E-10	6.58E-10	6.58E-10	6.58E-10	6.58E-10	6.58E-10
Benzo(a)pyrene	1.42E-09	1.58E-09	1.58E-09	1.58E-09	1.58E-09	1.58E-09
Benzo[a]anthracene	1.65E-08	1.83E-08	1.83E-08	1.83E-08	1.83E-08	1.83E-08
Benzo[b]flouranthene	3.23E-09	3.56E-09	3.56E-09	3.56E-09	3.56E-09	3.56E-09
Benzo[k]fluoranthene	1.98E-09	2.09E-09	2.09E-09	2.09E-09	2.09E-09	2.09E-09
Chrysene	3.42E-08	3.78E-08	3.78E-08	3.78E-08	3.78E-08	3.78E-08
Dibenz[a,h]anthracene	4.61E-10	5.34E-10	5.34E-10	5.34E-10	5.34E-10	5.34E-10
Indeno[1,2,3-cd]pyrene	3.16E-10	3.73E-10	3.73E-10	3.73E-10	3.73E-10	3.73E-10
Arsenic	1.91E-08	2.37E-08	2.37E-08	2.37E-08	2.37E-08	2.37E-08
Chromium VI	1.76E-07	2.20E-07	2.20E-07	2.20E-07	2.20E-07	2.20E-07
Noncarcinogens						
Benzaldehyde	7.88E-09	8.00E-09	8.00E-09	8.00E-09	8.00E-09	8.00E-09
Benzene	6.58E-10	6.58E-10	6.58E-10	6.58E-10	6.58E-10	6.58E-10
Methyl Ethyl Ketone (MEK)	5.24E-09	5.26E-09	5.26E-09	5.26E-09	5.26E-09	5.26E-09
Styrene	2.50E-10	2.50E-10	2.50E-10	2.50E-10	2.50E-10	2.50E-10
Toluene	2.15E-10	2.15E-10	2.15E-10	2.15E-10	2.15E-10	2.15E-10
o-Xylene	8.88E-11	8.88E-11	8.88E-11	8.88E-11	8.88E-11	8.88E-11
2-Methylnaphthalene	2.22E-11	2.23E-11	2.23E-11	2.23E-11	2.23E-11	2.23E-11
Acenaphthene	2.63E-10	2.63E-10	2.63E-10	2.63E-10	2.63E-10	2.63E-10
Acenaphthylene	2.33E-09	2.38E-09	2.38E-09	2.38E-09	2.38E-09	2.38E-09
Anthracene	2.61E-10	2.71E-10	2.71E-10	2.71E-10	2.71E-10	2.71E-10
Benzo(g,h,i)perylene	5.27E-09	4.31E-09	4.31E-09	4.31E-09	4.31E-09	4.31E-09
Fluoranthene	1.03E-08	1.13E-08	1.13E-08	1.13E-08	1.13E-08	1.13E-08
Fluorene	3.76E-10	3.76E-10	3.76E-10	3.76E-10	3.76E-10	3.76E-10

Table 43c (continued)

Chemical	Subsistence Farmer (mg/kg)	Subsistence Farmer Child (mg/kg)	Subsistence Fisher (mg/kg)	Subsistence Fisher Child (mg/kg)	Adult Resident (mg/kg)	Child Resident (mg/kg)
Furans	6.99E-11	6.99E-11	6.99E-11	6.99E-11	6.99E-11	6.99E-11
Manganese	NC	NC	NC	NC	NC	NC
Naphthalene	4.55E-09	4.56E-09	4.56E-09	4.56E-09	4.56E-09	4.56E-09
Phenol	1.27E-06	1.45E-06	1.45E-06	1.45E-06	1.45E-06	1.45E-06
Pyrene	6.47E-09	6.47E-09	6.47E-09	6.47E-09	6.47E-09	6.47E-09
n-Hexane	3.29E-13	3.29E-13	3.29E-13	3.29E-13	3.29E-13	3.29E-13
Antimony	5.78E-07	7.14E-07	7.14E-07	7.14E-07	7.14E-07	7.14E-07
Arsenic	1.91E-08	2.37E-08	2.37E-08	2.37E-08	2.37E-08	2.37E-08
Barium	6.43E-05	7.96E-05	7.96E-05	7.96E-05	7.96E-05	7.96E-05
Cadmium	5.94E-07	7.24E-07	7.24E-07	7.24E-07	7.24E-07	7.24E-07
Chlorine	1.11E-01	1.47E-01	1.47E-01	1.47E-01	1.47E-01	1.47E-01
Chromium	8.92E-12	7.22E-12	7.22E-12	7.22E-12	7.22E-12	7.22E-12
Chromium VI	1.76E-07	2.20E-07	2.20E-07	2.20E-07	2.20E-07	2.20E-07
Nickel	4.46E-08	5.47E-08	5.47E-08	5.47E-08	5.47E-08	5.47E-08
Selenium	2.97E-07	3.71E-07	3.71E-07	3.71E-07	3.71E-07	3.71E-07
Silver	2.45E-06	3.06E-06	3.06E-06	3.06E-06	3.06E-06	3.06E-06
Zinc	7.28E-07	8.92E-07	8.92E-07	8.92E-07	8.92E-07	8.92E-07

Table 44a Estimates of Fish Concentrations for the ARRF Scenario

Chemical	Subsistence Farmer (mg/kg)	Subsistence Farmer Child (mg/kg)	Subsistence Fisher (mg/kg)	Subsistence Fisher Child (mg/kg)	Adult Resident (mg/kg)	Child Resident (mg/kg)
Carcinogens						
Acetaldehyde	NA	NA	1.71E-06	1.71E-06	NA	NA
Benzene	NA	NA	2.03E-13	2.03E-13	NA	NA
Methylene Chloride	NA	NA	2.29E-12	2.29E-12	NA	NA
Tetrachloroethylene	NA	NA	5.11E-14	5.11E-14	NA	NA
Benzo[a]anthracene	NA	NA	2.17E-09	2.17E-09	NA	NA
Benzo[b]fluoranthene	NA	NA	2.12E-09	2.12E-09	NA	NA
Chrysene	NA	NA	4.13E-09	4.13E-09	NA	NA
Dibenz[a,h]anthracene	NA	NA	1.20E-10	1.20E-10	NA	NA
Formaldehyde	NA	NA	1.23E-12	1.23E-12	NA	NA
Indeno[1,2,3-cd]pyrene	NA	NA	1.26E-10	1.26E-10	NA	NA
2,3,7,8-TCDDioxin Toxicity Equivalents	NA	NA	9.33E-16	9.33E-16	NA	NA
Arsenic	NA	NA	4.03E-07	4.03E-07	NA	NA
Beryllium	NA	NA	6.00E-09	6.00E-09	NA	NA
Noncarcinogens						
Acetaldehyde	NA	NA	1.71E-06	1.71E-06	NA	NA
Benzene	NA	NA	2.03E-13	2.03E-13	NA	NA
Ethylbenzene	NA	NA	2.80E-13	2.80E-13	NA	NA
Methyl Chloroform	NA	NA	5.28E-13	5.28E-13	NA	NA
Methylene Chloride	NA	NA	2.29E-12	2.29E-12	NA	NA
Tetrachloroethylene	NA	NA	5.11E-14	5.11E-14	NA	NA
Toluene	NA	NA	2.61E-12	2.61E-12	NA	NA
Vinyl Acetate	NA	NA	5.98E-13	5.98E-13	NA	NA
o-Xylene	NA	NA	6.22E-13	6.22E-13	NA	NA
p-Xylene	NA	NA	1.51E-11	1.51E-11	NA	NA

Table 44a (continued)

Chemical	Subsistence Farmer (mg/kg)	Subsistence Farmer Child (mg/kg)	Subsistence Fisher (mg/kg)	Subsistence Fisher Child (mg/kg)	Adult Resident (mg/kg)	Child Resident (mg/kg)
2-Methylnaphthalene	NA	NA	4.87E-13	4.87E-13	NA	NA
Acenaphthene	NA	NA	3.72E-11	3.72E-11	NA	NA
Acenaphthylene	NA	NA	2.98E-13	2.98E-13	NA	NA
Anthracene	NA	NA	1.31E-11	1.31E-11	NA	NA
Benzo(g,h,i)perylene	NA	NA	NC	NC	NA	NA
Fluoranthene	NA	NA	1.45E-09	1.45E-09	NA	NA
Fluorene	NA	NA	1.09E-11	1.09E-11	NA	NA
Formaldehyde	NA	NA	1.23E-12	1.23E-12	NA	NA
Manganese	NA	NA	NC	NC	NA	NA
Naphthalene	NA	NA	4.84E-12	4.84E-12	NA	NA
Phenol	NA	NA	2.05E-08	2.05E-08	NA	NA
Pyrene	NA	NA	1.62E-09	1.62E-09	NA	NA
Arsenic	NA	NA	4.03E-07	4.03E-07	NA	NA
Beryllium	NA	NA	6.00E-09	6.00E-09	NA	NA
Cadmium	NA	NA	1.45E-07	1.45E-07	NA	NA
Chlorine	NA	NA	NC	NC	NA	NA
Chromium	NA	NA	1.88E-10	1.88E-10	NA	NA
Chromium VI	NA	NA	9.01E-08	9.01E-08	NA	NA
Nickel	NA	NA	6.61E-05	6.61E-05	NA	NA
Selenium	NA	NA	3.98E-06	3.98E-06	NA	NA

NC - Not Calculated NA - Not Available

Table 44b Estimates of Fish Concentrations for the Propane Scenario

Chemical	Subsistence Farmer (mg/kg)	Subsistence Farmer Child (mg/kg)	Subsistence Fisher (mg/kg)	Subsistence Fisher Child (mg/kg)	Adult Resident (mg/kg)	Child Resident (mg/kg)
Carcinogens						
Benzene	NA	NA	2.90E-12	2.90E-12	NA	NA
Formaldehyde	NA	NA	1.63E-11	1.63E-11	NA	NA
Arsenic	NA	NA	2.31E-09	2.31E-09	NA	NA
Noncarcinogens						
Benzene	NA	NA	2.90E-12	2.90E-12	NA	NA
Toluene	NA	NA	4.78E-11	4.78E-11	NA	NA
2-Methylnaphthalene	NA	NA	1.08E-11	1.08E-11	NA	NA
Fluoranthene	NA	NA	3.85E-09	3.85E-09	NA	NA
Fluorene	NA	NA	2.25E-11	2.25E-11	NA	NA
Formaldehyde	NA	NA	1.63E-11	1.63E-11	NA	NA
Naphthalene	NA	NA	1.38E-10	1.38E-10	NA	NA
Pyrene	NA	NA	3.19E-09	3.19E-09	NA	NA
Arsenic	NA	NA	2.31E-09	2.31E-09	NA	NA
Nickel	NA	NA	2.31E-07	2.31E-07	NA	NA

NA - Not Applicable

Table 44c Estimates of Fish Concentrations for the Drill Tower Scenario

Chemical	Subsistence Farmer (mg/kg)	Subsistence Farmer Child (mg/kg)	Subsistence Fisher (mg/kg)	Subsistence Fisher Child (mg/kg)	Adult Resident (mg/kg)	Child Resident (mg/kg)
Carcinogens						
Benzene	NA	NA	1.63E-08	1.63E-08	NA	NA
Benzo(a)pyrene	NA	NA	1.57E-05	1.57E-05	NA	NA
Benzo[a]anthracene	NA	NA	9.33E-05	9.33E-05	NA	NA
Benzo[b]flouranthene	NA	NA	3.55E-05	3.55E-05	NA	NA
Benzo[k]fluoranthene	NA	NA	2.08E-05	2.08E-05	NA	NA
Chrysene	NA	NA	2.28E-04	2.28E-04	NA	NA
Dibenz[a,h]anthracene	NA	NA	6.84E-06	6.84E-06	NA	NA
Indeno[1,2,3-cd]pyrene	NA	NA	4.89E-06	4.89E-06	NA	NA
Arsenic	NA	NA	4.75E-07	4.75E-07	NA	NA
Chromium VI	NA	NA	6.59E-07	6.59E-07	NA	NA
Noncarcinogens						
Benzaldehyde	NA	NA	6.25E-08	6.25E-08	NA	NA
Benzene	NA	NA	1.63E-08	1.63E-08	NA	NA
Methyl Ethyl Ketone (MEK)	NA	NA	5.05E-09	5.05E-09	NA	NA
Styrene	NA	NA	2.47E-08	2.47E-08	NA	NA
Toluene	NA	NA	1.35E-08	1.35E-08	NA	NA
o-Xylene	NA	NA	1.25E-08	1.25E-08	NA	NA
2-Methylnaphthalene	NA	NA	8.83E-09	8.83E-09	NA	NA
Acenaphthene	NA	NA	1.59E-07	1.59E-07	NA	NA
Acenaphthylene	NA	NA	1.38E-07	1.38E-07	NA	NA
Anthracene	NA	NA	7.05E-07	7.05E-07	NA	NA
Benzo(g,h,i)perylene	NA	NA	NC	NC	NA	NA
Fluoranthene	NA	NA	1.77E-04	1.77E-04	NA	NA
Fluorene	NA	NA	4.51E-07	4.51E-07	NA	NA

Table 44c (continued)

Chemical	Subsistence Farmer (mg/kg)	Subsistence Farmer Child (mg/kg)	Subsistence Fisher (mg/kg)	Subsistence Fisher Child (mg/kg)	Adult Resident (mg/kg)	Child Resident (mg/kg)
Furans	NA	NA	4.44E-10	4.44E-10	NA	NA
Manganese	NA	NA	NC	NC	NA	NA
Naphthalene	NA	NA	9.81E-07	9.81E-07	NA	NA
Phenol	NA	NA	1.14E-05	1.14E-05	NA	NA
Pyrene	NA	NA	7.69E-05	7.69E-05	NA	NA
n-Hexane	NA	NA	6.12E-11	6.12E-11	NA	NA
Antimony	NA	NA	2.86E-05	2.86E-05	NA	NA
Arsenic	NA	NA	4.75E-07	4.75E-07	NA	NA
Barium	NA	NA	5.04E-02	5.04E-02	NA	NA
Cadmium	NA	NA	1.81E-04	1.81E-04	NA	NA
Chlorine	NA	NA	NC	NC	NA	NA
Chromium	NA	NA	1.37E-09	1.37E-09	NA	NA
Chromium VI	NA	NA	6.59E-07	6.59E-07	NA	NA
Nickel	NA	NA	4.27E-06	4.27E-06	NA	NA
Selenium	NA	NA	4.79E-05	4.79E-05	NA	NA
Silver	NA	NA	6.24E-04	6.24E-04	NA	NA
Zinc	NA	NA	1.84E-03	1.84E-03	NA	NA

NC - Not Calculated NA - Not Applicable

Table 45a Estimates of Soil Intake for the ARFF Scenario

Chemical	Subsistence Farmer (mg/kg-day)	Subsistence Farmer Child (mg/kg-day)	Subsistence Fisher (mg/kg-day)	Subsistence Fisher Child (mg/kg-day)	Adult Resident (mg/kg-day)	Child Resident (mg/kg-day)
Carcinogens						
Acetaldehyde	1.53E-14	1.90E-13	2.04E-14	1.90E-13	2.04E-14	1.90E-13
Benzene	4.57E-18	5.69E-17	6.10E-18	5.69E-17	6.10E-18	5.69E-17
Methylene Chloride	5.27E-17	6.56E-16	7.03E-17	6.56E-16	7.03E-17	6.56E-16
Tetrachloroethylene	3.96E-18	4.93E-17	5.28E-18	4.93E-17	5.28E-18	4.93E-17
Benzo[a]anthracene	4.75E-14	5.42E-13	5.81E-14	5.42E-13	5.81E-14	5.42E-13
Benzo[b]fluoranthene	4.62E-14	5.30E-13	5.68E-14	5.30E-13	5.68E-14	5.30E-13
Chrysene	4.24E-14	4.67E-13	5.00E-14	4.67E-13	5.00E-14	4.67E-13
Dibenz[a,h]anthracene	1.72E-15	1.90E-14	2.03E-15	1.90E-14	2.03E-15	1.90E-14
Formaldehyde	1.91E-17	2.38E-16	2.55E-17	2.38E-16	2.55E-17	2.38E-16
Indeno[1,2,3-cd]pyrene	3.88E-15	4.38E-14	4.69E-15	4.38E-14	4.69E-15	4.38E-14
2,3,7,8-TCDDioxin Toxicity Equivalents	2.19E-17	2.01E-16	2.15E-17	2.01E-16	2.15E-17	2.01E-16
Arsenic	4.63E-13	5.66E-12	6.06E-13	5.66E-12	6.06E-13	5.66E-12
Beryllium	8.74E-13	7.98E-12	8.55E-13	7.98E-12	8.55E-13	7.98E-12
Noncarcinogens						
Acetaldehyde	1.53E-14	1.90E-13	2.04E-14	1.90E-13	2.04E-14	1.90E-13
Benzene	4.57E-18	5.69E-17	6.10E-18	5.69E-17	6.10E-18	5.69E-17
Ethylbenzene	5.72E-18	7.12E-17	7.63E-18	7.12E-17	7.63E-18	7.12E-17
Methyl Chloroform	3.98E-14	4.95E-13	5.30E-14	4.95E-13	5.30E-14	4.95E-13
Methylene Chloride	5.27E-17	6.56E-16	7.03E-17	6.56E-16	7.03E-17	6.56E-16
Tetrachloroethylene	3.96E-18	4.93E-17	5.28E-18	4.93E-17	5.28E-18	4.93E-17
Toluene	6.36E-17	7.92E-16	8.48E-17	7.92E-16	8.48E-17	7.92E-16
Vinyl Acetate	1.58E-17	1.97E-16	2.11E-17	1.97E-16	2.11E-17	1.97E-16
o-Xylene	1.45E-17	1.80E-16	1.93E-17	1.80E-16	1.93E-17	1.80E-16

Table 45a (continued)

Chemical	Subsistence Farmer (mg/kg-day)	Subsistence Farmer Child (mg/kg-day)	Subsistence Fisher (mg/kg-day)	Subsistence Fisher Child (mg/kg-day)	Adult Resident (mg/kg-day)	Child Resident (mg/kg-day)
Acenaphthene	1.03E-16	1.28E-15	1.37E-16	1.28E-15	1.37E-16	1.28E-15
Acenaphthylene	7.56E-16	9.39E-15	1.01E-15	9.39E-15	1.01E-15	9.39E-15
Anthracene	2.66E-15	3.29E-14	3.52E-15	3.29E-14	3.52E-15	3.29E-14
Benzo(g,h,i)perylene	5.07E-14	3.84E-13	4.12E-14	3.84E-13	4.12E-14	3.84E-13
Fluoranthene	1.42E-14	1.69E-13	1.82E-14	1.69E-13	1.82E-14	1.69E-13
Fluorene	1.97E-18	2.45E-17	2.63E-18	2.45E-17	2.63E-18	2.45E-17
Formaldehyde	1.91E-17	2.38E-16	2.55E-17	2.38E-16	2.55E-17	2.38E-16
Manganese	2.18E-15	2.71E-14	2.90E-15	2.71E-14	2.90E-15	2.71E-14
Naphthalene	5.28E-16	6.57E-15	7.04E-16	6.57E-15	7.04E-16	6.57E-15
Phenol	7.64E-14	9.50E-13	1.02E-13	9.50E-13	1.02E-13	9.50E-13
Pyrene	5.74E-19	7.14E-18	7.65E-19	7.14E-18	7.65E-19	7.14E-18
Arsenic	4.63E-13	5.66E-12	6.06E-13	5.66E-12	6.06E-13	5.66E-12
Beryllium	8.74E-13	7.98E-12	8.55E-13	7.98E-12	8.55E-13	7.98E-12
Cadmium	7.79E-14	9.25E-13	9.91E-14	9.25E-13	9.91E-14	9.25E-13
Chlorine	1.25E-11	1.55E-10	1.66E-11	1.55E-10	1.66E-11	1.55E-10
Chromium	2.20E-11	1.64E-10	1.76E-11	1.64E-10	1.76E-11	1.64E-10
Chromium VI	3.09E-13	3.80E-12	4.07E-13	3.80E-12	4.07E-13	3.80E-12
Nickel	8.79E-11	1.05E-09	1.13E-10	1.05E-09	1.13E-10	1.05E-09
Selenium	2.54E-14	3.15E-13	3.37E-14	3.15E-13	3.37E-14	3.15E-13

Table 45b Estimates of Soil Intake for the Propane Scenario

Chemical	Subsistence Farmer (mg/kg-day)	Subsistence Farmer Child (mg/kg-day)	Subsistence Fisher (mg/kg-day)	Subsistence Fisher Child (mg/kg-day)	Adult Resident (mg/kg-day)	Child Resident (mg/kg-day)
Carcinogens						
Benzene	3.51E-17	4.36E-16	4.67E-17	4.36E-16	4.67E-17	4.36E-16
Formaldehyde	1.42E-16	1.77E-15	1.89E-16	1.77E-15	1.89E-16	1.77E-15
Arsenic	1.44E-15	1.76E-14	1.89E-15	1.76E-14	1.89E-15	1.76E-14
Noncarcinogens						
Benzene	3.51E-17	4.36E-16	4.67E-17	4.36E-16	4.67E-17	4.36E-16
Toluene	6.22E-16	7.74E-15	8.29E-16	7.74E-15	8.29E-16	7.74E-15
2-Methylnaphthalene	1.04E-15	1.30E-14	1.39E-15	1.30E-14	1.39E-15	1.30E-14
Fluoranthene	2.04E-14	2.43E-13	2.61E-14	2.43E-13	2.61E-14	2.43E-13
Fluorene	2.16E-18	2.68E-17	2.88E-18	2.68E-17	2.88E-18	2.68E-17
Formaldehyde	1.42E-16	1.77E-15	1.89E-16	1.77E-15	1.89E-16	1.77E-15
Naphthalene	7.97E-15	9.92E-14	1.06E-14	9.92E-14	1.06E-14	9.92E-14
Pyrene	5.94E-19	7.39E-18	7.92E-19	7.39E-18	7.92E-19	7.39E-18
Arsenic	1.44E-15	1.76E-14	1.89E-15	1.76E-14	1.89E-15	1.76E-14
Nickel	1.67E-13	2.00E-12	2.14E-13	2.00E-12	2.14E-13	2.00E-12

Table 45c Estimates of Soil Intake for the Drill Tower Scenario

Chemical	Subsistence Farmer (mg/kg-day)	Subsistence Farmer Child (mg/kg-day)	Subsistence Fisher (mg/kg-day)	Subsistence Fisher Child (mg/kg-day)	Adult Resident (mg/kg-day)	Child Resident (mg/kg-day)
Carcinogens						
Benzene	7.32E-13	9.11E-12	9.76E-13	9.11E-12	9.76E-13	9.11E-12
Benzo(a)pyrene	3.08E-10	3.57E-09	3.83E-10	3.57E-09	3.83E-10	3.57E-09
Benzo[a]anthracene	4.14E-09	4.73E-08	5.07E-09	4.73E-08	5.07E-09	4.73E-08
Benzo[b]flouranthene	1.57E-09	1.80E-08	1.93E-09	1.80E-08	1.93E-09	1.80E-08
Benzo[k]fluoranthene	6.01E-10	5.98E-09	6.41E-10	5.98E-09	6.41E-10	5.98E-09
Chrysene	4.80E-09	5.29E-08	5.67E-09	5.29E-08	5.67E-09	5.29E-08
Dibenz[a,h]anthracene	4.12E-10	4.53E-09	4.86E-10	4.53E-09	4.86E-10	4.53E-09
Indeno[1,2,3-cd]pyrene	6.33E-10	7.15E-09	7.66E-10	7.15E-09	7.66E-10	7.15E-09
Arsenic	2.23E-12	2.72E-11	2.92E-12	2.72E-11	2.92E-12	2.72E-11
Chromium VI	9.23E-12	1.13E-10	1.22E-11	1.13E-10	1.22E-11	1.13E-10
Noncarcinogens						
Benzaldehyde	4.28E-12	5.33E-11	5.71E-12	5.33E-11	5.71E-12	5.33E-11
Benzene	7.32E-13	9.11E-12	9.76E-13	9.11E-12	9.76E-13	9.11E-12
Methyl Ethyl Ketone (MEK)	1.87E-13	2.32E-12	2.49E-13	2.32E-12	2.49E-13	2.32E-12
Styrene	6.19E-12	7.70E-11	8.25E-12	7.70E-11	8.25E-12	7.70E-11
Toluene	6.52E-13	8.11E-12	8.69E-13	8.11E-12	8.69E-13	8.11E-12
o-Xylene	5.77E-13	7.18E-12	7.69E-13	7.18E-12	7.69E-13	7.18E-12
2-Methylnaphthalene	3.18E-12	3.96E-11	4.24E-12	3.96E-11	4.24E-12	3.96E-11
Acenaphthene	8.64E-13	1.08E-11	1.15E-12	1.08E-11	1.15E-12	1.08E-11
Acenaphthylene	6.91E-10	8.58E-09	9.20E-10	8.58E-09	9.20E-10	8.58E-09
Anthracene	2.82E-10	3.48E-09	3.73E-10	3.48E-09	3.73E-10	3.48E-09
Benzo(g,h,i)perylene	3.49E-09	2.64E-08	2.83E-09	2.64E-08	2.83E-09	2.64E-08
Fluoranthene	3.48E-09	4.16E-08	4.45E-09	4.16E-08	4.45E-09	4.16E-08

Table 45c (continued)

Chemical	Subsistence Farmer (mg/kg-day)	Subsistence Farmer Child (mg/kg-day)	Subsistence Fisher (mg/kg-day)	Subsistence Fisher Child (mg/kg-day)	Adult Resident (mg/kg-day)	Child Resident (mg/kg-day)
Fluorene	1.61E-13	2.00E-12	2.15E-13	2.00E-12	2.15E-13	2.00E-12
Furans	2.95E-14	3.67E-13	3.94E-14	3.67E-13	3.94E-14	3.67E-13
Manganese	2.02E-13	2.51E-12	2.69E-13	2.51E-12	2.69E-13	2.51E-12
Naphthalene	2.11E-10	2.62E-09	2.81E-10	2.62E-09	2.81E-10	2.62E-09
Phenol	8.52E-11	1.06E-09	1.14E-10	1.06E-09	1.14E-10	1.06E-09
Pyrene	5.33E-14	6.63E-13	7.11E-14	6.63E-13	7.11E-14	6.63E-13
n-Hexane	1.64E-15	2.04E-14	2.18E-15	2.04E-14	2.18E-15	2.04E-14
Antimony	1.53E-10	1.85E-09	1.99E-10	1.85E-09	1.99E-10	1.85E-09
Arsenic	2.23E-12	2.72E-11	2.92E-12	2.72E-11	2.92E-12	2.72E-11
Barium	1.43E-08	1.74E-07	1.86E-08	1.74E-07	1.86E-08	1.74E-07
Cadmium	3.98E-10	4.73E-09	5.06E-10	4.73E-09	5.06E-10	4.73E-09
Chlorine	9.59E-10	1.19E-08	1.28E-09	1.19E-08	1.28E-09	1.19E-08
Chromium	6.56E-10	4.90E-09	5.25E-10	4.90E-09	5.25E-10	4.90E-09
Chromium VI	9.23E-12	1.13E-10	1.22E-11	1.13E-10	1.22E-11	1.13E-10
Nickel	2.32E-11	2.77E-10	2.96E-11	2.77E-10	2.96E-11	2.77E-10
Selenium	1.25E-12	1.55E-11	1.66E-12	1.55E-11	1.66E-12	1.55E-11
Silver	2.66E-11	3.29E-10	3.52E-11	3.29E-10	3.52E-11	3.29E-10
Zinc	3.47E-10	4.15E-09	4.44E-10	4.15E-09	4.44E-10	4.15E-09

Table 46a Estimates of Vegetation Intake for the ARFF Scenario

Chemical	Subsistence Farmer (mg/kg-day)	Subsistence Farmer Child (mg/kg-day)	Subsistence Fisher (mg/kg-day)	Subsistence Fisher Child (mg/kg-day)	Adult Resident (mg/kg-day)	Child Resident (mg/kg-day)
Carcinogens						
Acetaldehyde	1.50E-09	3.01E-09	5.00E-10	7.52E-10	5.00E-10	7.52E-10
Benzene	1.82E-14	3.65E-14	6.08E-15	9.12E-15	6.08E-15	9.12E-15
Methylene Chloride	6.71E-13	1.34E-12	2.24E-13	3.36E-13	2.24E-13	3.36E-13
Tetrachloroethylene	7.20E-15	1.42E-14	2.40E-15	3.56E-15	2.40E-15	3.56E-15
Benzo[a]anthracene	6.98E-13	1.19E-12	2.13E-13	2.97E-13	2.13E-13	2.97E-13
Benzo[b]fluoranthene	3.91E-13	6.68E-13	1.18E-13	1.67E-13	1.18E-13	1.67E-13
Chrysene	5.98E-13	9.79E-13	1.75E-13	2.45E-13	1.75E-13	2.45E-13
Dibenz[a,h]anthracene	1.17E-13	1.66E-13	2.95E-14	4.14E-14	2.95E-14	4.14E-14
Formaldehyde	7.69E-13	1.53E-12	2.56E-13	3.83E-13	2.56E-13	3.83E-13
Indeno[1,2,3-cd]pyrene	1.10E-12	1.55E-12	2.77E-13	3.87E-13	2.77E-13	3.87E-13
2,3,7,8-TCDDioxin Toxicity Equivalents	9.88E-17	1.38E-16	2.44E-17	3.45E-17	2.44E-17	3.45E-17
Arsenic	1.26E-11	1.86E-11	3.32E-12	4.65E-12	3.32E-12	4.65E-12
Beryllium	3.40E-12	4.68E-12	8.42E-13	1.17E-12	8.42E-13	1.17E-12
Noncarcinogens						
Acetaldehyde	1.50E-09	3.01E-09	5.00E-10	7.52E-10	5.00E-10	7.52E-10
Benzene	1.82E-14	3.65E-14	6.08E-15	9.12E-15	6.08E-15	9.12E-15
Ethylbenzene	2.01E-14	4.15E-14	6.69E-15	1.04E-14	6.69E-15	1.04E-14
Methyl Chloroform	3.74E-11	6.81E-11	1.25E-11	1.70E-11	1.25E-11	1.70E-11
Methylene Chloride	6.71E-13	1.34E-12	2.24E-13	3.36E-13	2.24E-13	3.36E-13
Tetrachloroethylene	7.20E-15	1.42E-14	2.40E-15	3.56E-15	2.40E-15	3.56E-15
Toluene	1.88E-13	3.83E-13	6.28E-14	9.57E-14	6.28E-14	9.57E-14
Vinyl Acetate	3.69E-13	7.33E-13	1.23E-13	1.83E-13	1.23E-13	1.83E-13
o-Xylene	4.42E-14	9.12E-14	1.47E-14	2.28E-14	1.47E-14	2.28E-14

Table 46a (continued)

Chemical	Subsistence Farmer (mg/kg-day)	Subsistence Farmer Child (mg/kg-day)	Subsistence Fisher (mg/kg-day)	Subsistence Fisher Child (mg/kg-day)	Adult Resident (mg/kg-day)	Child Resident (mg/kg-day)
Acenaphthene	7.17E-14	1.44E-13	2.35E-14	3.60E-14	2.35E-14	3.60E-14
Acenaphthylene	1.30E-13	2.46E-13	4.32E-14	6.15E-14	4.32E-14	6.15E-14
Anthracene	1.71E-13	3.11E-13	5.65E-14	7.78E-14	5.65E-14	7.78E-14
Benzo(g,h,i)perylene	2.04E-13	2.37E-13	4.27E-14	5.91E-14	4.27E-14	5.91E-14
Fluoranthene	4.41E-13	7.85E-13	1.41E-13	1.96E-13	1.41E-13	1.96E-13
Fluorene	2.04E-16	3.69E-16	6.70E-17	9.23E-17	6.70E-17	9.23E-17
Formaldehyde	7.69E-13	1.53E-12	2.56E-13	3.83E-13	2.56E-13	3.83E-13
Manganese	2.25E-11	3.15E-11	5.63E-12	7.88E-12	5.63E-12	7.88E-12
Naphthalene	5.66E-13	1.15E-12	1.89E-13	2.87E-13	1.89E-13	2.87E-13
Phenol	5.76E-10	1.14E-09	1.92E-10	2.84E-10	1.92E-10	2.84E-10
Pyrene	1.56E-15	2.19E-15	3.92E-16	5.48E-16	3.92E-16	5.48E-16
Arsenic	1.26E-11	1.86E-11	3.32E-12	4.65E-12	3.32E-12	4.65E-12
Beryllium	3.40E-12	4.68E-12	8.42E-13	1.17E-12	8.42E-13	1.17E-12
Cadmium	7.85E-12	1.33E-11	2.40E-12	3.33E-12	2.40E-12	3.33E-12
Chlorine	NC	NC	NC	NC	NC	NC
Chromium	9.73E-11	1.15E-10	2.06E-11	2.87E-11	2.06E-11	2.87E-11
Chromium VI	2.33E-11	3.31E-11	5.91E-12	8.28E-12	5.91E-12	8.28E-12
Nickel	2.43E-09	3.61E-09	6.46E-10	9.04E-10	6.46E-10	9.04E-10
Selenium	3.61E-12	5.22E-12	9.32E-13	1.30E-12	9.32E-13	1.30E-12

NC - Not Calculated

Table 46b Estimates of Vegetation Intake for the Propane Scenario

Chemical	Subsistence Farmer (mg/kg-day)	Subsistence Farmer Child (mg/kg-day)	Subsistence Fisher (mg/kg-day)	Subsistence Fisher Child (mg/kg-day)	Adult Resident (mg/kg-day)	Child Resident (mg/kg-day)
Carcinogens						
Benzene	1.40E-13	2.80E-13	4.66E-14	7.00E-14	4.66E-14	7.00E-14
Formaldehyde	5.70E-12	1.14E-11	1.90E-12	2.84E-12	1.90E-12	2.84E-12
Arsenic	7.39E-14	1.06E-13	1.90E-14	2.66E-14	1.90E-14	2.66E-14
Noncarcinogens						
Benzene	1.40E-13	2.80E-13	4.66E-14	7.00E-14	4.66E-14	7.00E-14
Toluene	1.84E-12	3.74E-12	6.13E-13	9.35E-13	6.13E-13	9.35E-13
2-Methylnaphthalene	2.28E-13	4.30E-13	7.60E-14	1.08E-13	7.60E-14	1.08E-13
Fluoranthene	6.33E-13	1.13E-12	2.02E-13	2.82E-13	2.02E-13	2.82E-13
Fluorene	2.22E-16	4.03E-16	7.30E-17	1.01E-16	7.30E-17	1.01E-16
Formaldehyde	5.70E-12	1.14E-11	1.90E-12	2.84E-12	1.90E-12	2.84E-12
Naphthalene	8.55E-12	1.73E-11	2.85E-12	4.33E-12	2.85E-12	4.33E-12
Pyrene	1.56E-15	2.19E-15	3.91E-16	5.48E-16	3.91E-16	5.48E-16
Arsenic	7.39E-14	1.06E-13	1.90E-14	2.66E-14	1.90E-14	2.66E-14
Nickel	5.51E-12	8.13E-12	1.45E-12	2.03E-12	1.45E-12	2.03E-12

Table 46c Estimates of Vegetation Intake for the Drill Tower Scenario

Chemical	Subsistence Farmer (mg/kg-day)	Subsistence Farmer Child (mg/kg-day)	Subsistence Fisher (mg/kg-day)	Subsistence Fisher Child (mg/kg-day)	Adult Resident (mg/kg-day)	Child Resident (mg/kg-day)
Carcinogens						
Benzene	2.92E-09	5.85E-09	9.73E-10	1.46E-09	9.73E-10	1.46E-09
Benzo(a)pyrene	5.01E-09	7.84E-09	1.40E-09	1.96E-09	1.40E-09	1.96E-09
Benzo[a]anthracene	6.18E-08	1.05E-07	1.88E-08	2.62E-08	1.88E-08	2.62E-08
Benzo[b]flouranthene	1.39E-08	2.35E-08	4.18E-09	5.89E-09	4.18E-09	5.89E-09
Benzo[k]fluoranthene	6.94E-09	1.02E-08	1.81E-09	2.55E-09	1.81E-09	2.55E-09
Chrysene	6.94E-08	1.13E-07	2.03E-08	2.83E-08	2.03E-08	2.83E-08
Dibenz[a,h]anthracene	8.97E-09	1.32E-08	2.34E-09	3.29E-09	2.34E-09	3.29E-09
Indeno[1,2,3-cd]pyrene	2.88E-08	4.11E-08	7.32E-09	1.03E-08	7.32E-09	1.03E-08
Arsenic	1.67E-10	2.38E-10	4.25E-11	5.94E-11	4.25E-11	5.94E-11
Chromium VI	1.03E-09	1.46E-09	2.60E-10	3.64E-10	2.60E-10	3.64E-10
Noncarcinogens						
Benzaldehyde	3.39E-08	6.73E-08	1.13E-08	1.68E-08	1.13E-08	1.68E-08
Benzene	2.92E-09	5.85E-09	9.73E-10	1.46E-09	9.73E-10	1.46E-09
Methyl Ethyl Ketone (MEK)	8.27E-09	1.65E-08	2.76E-09	4.13E-09	2.76E-09	4.13E-09
Styrene	6.16E-09	1.21E-08	2.05E-09	3.03E-09	2.05E-09	3.03E-09
Toluene	1.93E-09	3.93E-09	6.44E-10	9.81E-10	6.44E-10	9.81E-10
o-Xylene	1.76E-09	3.63E-09	5.87E-10	9.08E-10	5.87E-10	9.08E-10
2-Methylnaphthalene	6.95E-10	1.31E-09	2.32E-10	3.28E-10	2.32E-10	3.28E-10
Acenaphthene	6.07E-10	1.22E-09	1.99E-10	3.04E-10	1.99E-10	3.04E-10
Acenaphthylene	1.19E-07	2.25E-07	3.95E-08	5.62E-08	3.95E-08	5.62E-08
Anthracene	1.81E-08	3.30E-08	5.99E-09	8.24E-09	5.99E-09	8.24E-09
Benzo(g,h,i)perylene	1.58E-08	1.88E-08	3.38E-09	4.69E-09	3.38E-09	4.69E-09
Fluoranthene	1.08E-07	1.93E-07	3.46E-08	4.81E-08	3.46E-08	4.81E-08

Table 46c (continued)

Chemical	Subsistence Farmer (mg/kg-day)	Subsistence Farmer Child (mg/kg-day)	Subsistence Fisher (mg/kg-day)	Subsistence Fisher Child (mg/kg-day)	Adult Resident (mg/kg-day)	Child Resident (mg/kg-day)
Fluorene	1.72E-11	3.09E-11	5.59E-12	7.71E-12	5.59E-12	7.71E-12
Furans	1.30E-10	2.42E-10	4.34E-11	6.05E-11	4.34E-11	6.05E-11
Manganese	3.14E-09	4.39E-09	7.84E-10	1.10E-09	7.84E-10	1.10E-09
Naphthalene	2.26E-07	4.58E-07	7.53E-08	1.15E-07	7.53E-08	1.15E-07
Phenol	6.42E-07	1.27E-06	2.14E-07	3.17E-07	2.14E-07	3.17E-07
Pyrene	2.06E-10	2.89E-10	5.16E-11	7.22E-11	5.16E-11	7.22E-11
n-Hexane	1.42E-12	2.45E-12	4.26E-13	6.13E-13	4.26E-13	6.13E-13
Antimony	1.04E-08	1.59E-08	2.84E-09	3.98E-09	2.84E-09	3.98E-09
Arsenic	1.67E-10	2.38E-10	4.25E-11	5.94E-11	4.25E-11	5.94E-11
Barium	1.02E-06	1.55E-06	2.79E-07	3.88E-07	2.79E-07	3.88E-07
Cadmium	4.38E-08	7.31E-08	1.32E-08	1.83E-08	1.32E-08	1.83E-08
Chlorine	NC	NC	NC	NC	NC	NC
Chromium	3.24E-09	3.90E-09	6.98E-10	9.74E-10	6.98E-10	9.74E-10
Chromium VI	1.03E-09	1.46E-09	2.60E-10	3.64E-10	2.60E-10	3.64E-10
Nickel	8.86E-10	1.30E-09	2.32E-10	3.24E-10	2.32E-10	3.24E-10
Selenium	5.14E-10	7.27E-10	1.30E-10	1.82E-10	1.30E-10	1.82E-10
Silver	9.01E-09	1.37E-08	2.46E-09	3.43E-09	2.46E-09	3.43E-09
Zinc	2.82E-08	4.58E-08	8.24E-09	1.15E-08	8.24E-09	1.15E-08

NC - Not Calculated

Table 47a Estimates of Beef Intake for the ARFF Scenario

Chemical	Subsistence Farmer (mg/kg-day)	Subsistence Farmer Child (mg/kg-day)	Subsistence Fisher (mg/kg-day)	Subsistence Fisher Child (mg/kg-day)	Adult Resident (mg/kg-day)	Child Resident (mg/kg-day)
Carcinogens						
Acetaldehyde	1.13E-16	6.72E-17	NA	NA	NA	NA
Benzene	3.39E-19	2.02E-19	NA	NA	NA	NA
Methylene Chloride	1.64E-18	9.80E-19	NA	NA	NA	NA
Tetrachloroethylene	4.45E-19	2.65E-19	NA	NA	NA	NA
Benzo[a]anthracene	NC	NC	NA	NA	NA	NA
Benzo[b]fluoranthene	NC	NC	NA	NA	NA	NA
Chrysene	NC	NC	NA	NA	NA	NA
Dibenz[a,h]anthracene	NC	NC	NA	NA	NA	NA
Formaldehyde	2.45E-19	1.46E-19	NA	NA	NA	NA
Indeno[1,2,3-cd]pyrene	NC	NC	NA	NA	NA	NA
2,3,7,8-TCDDioxin Toxicity Equivalents	1.64E-15	7.29E-16	NA	NA	NA	NA
Arsenic	9.16E-12	4.19E-12	NA	NA	NA	NA
Beryllium	1.21E-12	5.39E-13	NA	NA	NA	NA
Noncarcinogens						
Acetaldehyde	1.13E-16	6.72E-17	NA	NA	NA	NA
Benzene	3.39E-19	2.02E-19	NA	NA	NA	NA
Ethylbenzene	1.18E-18	7.03E-19	NA	NA	NA	NA
Methyl Chloroform	3.92E-15	2.34E-15	NA	NA	NA	NA
Methylene Chloride	1.64E-18	9.80E-19	NA	NA	NA	NA
Tetrachloroethylene	4.45E-19	2.65E-19	NA	NA	NA	NA
Toluene	8.11E-18	4.83E-18	NA	NA	NA	NA
Vinyl Acetate	2.87E-19	1.71E-19	NA	NA	NA	NA
o-Xylene	3.02E-18	1.79E-18	NA	NA	NA	NA

Table 47a (continued)

Chemical	Subsistence Farmer (mg/kg-day)	Subsistence Farmer Child (mg/kg-day)	Subsistence Fisher (mg/kg-day)	Subsistence Fisher Child (mg/kg-day)	Adult Resident (mg/kg-day)	Child Resident (mg/kg-day)
Acenaphthene	NC	NC	NA	NA	NA	NA
Acenaphthylene	NC	NC	NA	NA	NA	NA
Anthracene	2.69E-15	1.59E-15	NA	NA	NA	NA
Benzo(g,h,i)perylene	NC	NC	NA	NA	NA	NA
Fluoranthene	NC	NC	NA	NA	NA	NA
Fluorene	1.65E-17	7.57E-18	NA	NA	NA	NA
Formaldehyde	2.45E-19	1.46E-19	NA	NA	NA	NA
Manganese	NC	NC	NA	NA	NA	NA
Naphthalene	1.41E-16	8.40E-17	NA	NA	NA	NA
Phenol	2.96E-15	1.77E-15	NA	NA	NA	NA
Pyrene	1.23E-14	5.51E-15	NA	NA	NA	NA
Arsenic	9.16E-12	4.19E-12	NA	NA	NA	NA
Beryllium	1.21E-12	5.39E-13	NA	NA	NA	NA
Cadmium	1.05E-13	5.14E-14	NA	NA	NA	NA
Chlorine	3.98E-10	2.37E-10	NA	NA	NA	NA
Chromium	1.06E-10	4.25E-11	NA	NA	NA	NA
Chromium VI	5.04E-11	2.26E-11	NA	NA	NA	NA
Nickel	4.89E-09	2.23E-09	NA	NA	NA	NA
Selenium	3.02E-12	1.36E-12	NA	NA	NA	NA

NC - Not Calculated NA - Not Applicable

Table 47b Estimates of Beef Intake for the Propane Scenario

Chemical	Subsistence Farmer (mg/kg-day)	Subsistence Farmer Child (mg/kg-day)	Subsistence Fisher (mg/kg-day)	Subsistence Fisher Child (mg/kg-day)	Adult Resident (mg/kg-day)	Child Resident (mg/kg-day)
Carcinogens						
Benzene	2.60E-18	1.55E-18	NA	NA	NA	NA
Formaldehyde	1.82E-18	1.08E-18	NA	NA	NA	NA
Arsenic	5.66E-14	2.56E-14	NA	NA	NA	NA
Noncarcinogens						
Benzene	2.60E-18	1.55E-18	NA	NA	NA	NA
Toluene	7.93E-17	4.72E-17	NA	NA	NA	NA
2-Methylnaphthalene	1.29E-16	7.72E-17	NA	NA	NA	NA
Fluoranthene	6.19E-14	3.40E-14	NA	NA	NA	NA
Fluorene	1.95E-17	8.93E-18	NA	NA	NA	NA
Formaldehyde	1.82E-18	1.08E-18	NA	NA	NA	NA
Naphthalene	2.13E-15	1.27E-15	NA	NA	NA	NA
Pyrene	1.39E-14	6.23E-15	NA	NA	NA	NA
Arsenic	5.66E-14	2.56E-14	NA	NA	NA	NA
Nickel	1.15E-11	5.22E-12	NA	NA	NA	NA

NA - Not Applicable

Table 47c Estimates of Beef Intake for the Drill Tower Scenario

Chemical	Subsistence Farmer (mg/kg-day)	Subsistence Farmer Child (mg/kg-day)	Subsistence Fisher (mg/kg-day)	Subsistence Fisher Child (mg/kg-day)	Adult Resident (mg/kg-day)	Child Resident (mg/kg-day)
Carcinogens						
Benzene	5.44E-14	3.24E-14	NA	NA	NA	NA
Benzo(a)pyrene	NC	NC	NA	NA	NA	NA
Benzo[a]anthracene	NC	NC	NA	NA	NA	NA
Benzo[b]flouranthene	NC	NC	NA	NA	NA	NA
Benzo[k]fluoranthene	NC	NC	NA	NA	NA	NA
Chrysene	NC	NC	NA	NA	NA	NA
Dibenz[a,h]anthracene	NC	NC	NA	NA	NA	NA
Indeno[1,2,3-cd]pyrene	NC	NC	NA	NA	NA	NA
Arsenic	1.30E-10	5.85E-11	NA	NA	NA	NA
Chromium VI	2.25E-09	1.01E-09	NA	NA	NA	NA
Noncarcinogens						
Benzaldehyde	1.66E-13	9.88E-14	NA	NA	NA	NA
Benzene	5.44E-14	3.24E-14	NA	NA	NA	NA
Methyl Ethyl Ketone (MEK)	2.25E-15	1.34E-15	NA	NA	NA	NA
Styrene	1.03E-12	6.12E-13	NA	NA	NA	NA
Toluene	8.32E-14	4.95E-14	NA	NA	NA	NA
o-Xylene	1.20E-13	7.15E-14	NA	NA	NA	NA
2-Methylnaphthalene	3.95E-13	2.35E-13	NA	NA	NA	NA
Acenaphthene	NC	NC	NA	NA	NA	NA
Acenaphthylene	NC	NC	NA	NA	NA	NA
Anthracene	NC	NC	NA	NA	NA	NA
Benzo(g,h,i)perylene	NC	NC	NA	NA	NA	NA
Fluoranthene	NC	NC	NA	NA	NA	NA

Table 47c (continued)

Chemical	Subsistence Farmer (mg/kg-day)	Subsistence Farmer Child (mg/kg-day)	Subsistence Fisher (mg/kg-day)	Subsistence Fisher Child (mg/kg-day)	Adult Resident (mg/kg-day)	Child Resident (mg/kg-day)
Fluorene	1.51E-12	6.92E-13	NA	NA	NA	NA
Furans	1.02E-15	6.10E-16	NA	NA	NA	NA
Manganese	NC	NC	NA	NA	NA	NA
Naphthalene	5.63E-11	3.35E-11	NA	NA	NA	NA
Phenol	3.30E-12	1.97E-12	NA	NA	NA	NA
Pyrene	1.29E-09	5.77E-10	NA	NA	NA	NA
n-Hexane	1.45E-15	7.06E-16	NA	NA	NA	NA
Antimony	3.16E-09	1.46E-09	NA	NA	NA	NA
Arsenic	1.30E-10	5.85E-11	NA	NA	NA	NA
Barium	4.77E-08	2.19E-08	NA	NA	NA	NA
Cadmium	7.15E-10	3.42E-10	NA	NA	NA	NA
Chlorine	3.06E-08	1.83E-08	NA	NA	NA	NA
Chromium	3.92E-09	1.60E-09	NA	NA	NA	NA
Chromium VI	2.25E-09	1.01E-09	NA	NA	NA	NA
Nickel	1.89E-09	8.55E-10	NA	NA	NA	NA
Selenium	4.58E-10	2.05E-10	NA	NA	NA	NA
Silver	8.25E-09	3.74E-09	NA	NA	NA	NA
Zinc	5.06E-10	2.37E-10	NA	NA	NA	NA

NC - Not Calculated NA - Not Applicable

Table 48a Estimates of Milk Intake for the ARFF Scenario

Chemical	Subsistence Farmer (mg/kg-day)	Subsistence Farmer Child (mg/kg-day)	Subsistence Fisher (mg/kg-day)	Subsistence Fisher Child (mg/kg-day)	Adult Resident (mg/kg-day)	Child Resident (mg/kg-day)
Carcinogens						
Acetaldehyde	4.54E-16	1.33E-15	NA	NA	NA	NA
Benzene	1.36E-18	3.99E-18	NA	NA	NA	NA
Methylene Chloride	6.60E-18	1.94E-17	NA	NA	NA	NA
Tetrachloroethylene	1.76E-18	5.18E-18	NA	NA	NA	NA
Benzo[a]anthracene	NC	NC	NA	NA	NA	NA
Benzo[b]fluoranthene	NC	NC	NA	NA	NA	NA
Chrysene	NC	NC	NA	NA	NA	NA
Dibenz[a,h]anthracene	NC	NC	NA	NA	NA	NA
Formaldehyde	9.87E-19	2.90E-18	NA	NA	NA	NA
Indeno[1,2,3-cd]pyrene	NC	NC	NA	NA	NA	NA
2,3,7,8-TCDDioxin Toxicity Equivalents	3.06E-15	6.73E-15	NA	NA	NA	NA
Arsenic	3.02E-12	6.79E-12	NA	NA	NA	NA
Beryllium	1.07E-14	2.34E-14	NA	NA	NA	NA
Noncarcinogens						
Acetaldehyde	4.54E-16	1.33E-15	NA	NA	NA	NA
Benzene	1.36E-18	3.99E-18	NA	NA	NA	NA
Ethylbenzene	4.58E-18	1.34E-17	NA	NA	NA	NA
Methyl Chloroform	1.56E-14	4.58E-14	NA	NA	NA	NA
Methylene Chloride	6.60E-18	1.94E-17	NA	NA	NA	NA
Tetrachloroethylene	1.76E-18	5.18E-18	NA	NA	NA	NA
Toluene	3.19E-17	9.37E-17	NA	NA	NA	NA
Vinyl Acetate	1.15E-18	3.38E-18	NA	NA	NA	NA
o-Xylene	1.17E-17	3.42E-17	NA	NA	NA	NA

Table 48a (continued)

Chemical	Subsistence Farmer (mg/kg-day)	Subsistence Farmer Child (mg/kg-day)	Subsistence Fisher (mg/kg-day)	Subsistence Fisher Child (mg/kg-day)	Adult Resident (mg/kg-day)	Child Resident (mg/kg-day)
Acenaphthene	NC	NC	NA	NA	NA	NA
Acenaphthylene	NC	NC	NA	NA	NA	NA
Anthracene	9.10E-15	2.65E-14	NA	NA	NA	NA
Benzo(g,h,i)perylene	NC	NC	NA	NA	NA	NA
Fluoranthene	NC	NC	NA	NA	NA	NA
Fluorene	5.84E-17	1.32E-16	NA	NA	NA	NA
Formaldehyde	9.87E-19	2.90E-18	NA	NA	NA	NA
Manganese	NC	NC	NA	NA	NA	NA
Naphthalene	5.40E-16	1.59E-15	NA	NA	NA	NA
Phenol	1.19E-14	3.48E-14	NA	NA	NA	NA
Pyrene	4.37E-14	9.64E-14	NA	NA	NA	NA
Arsenic	3.02E-12	6.79E-12	NA	NA	NA	NA
Beryllium	1.07E-14	2.34E-14	NA	NA	NA	NA
Cadmium	6.52E-14	1.58E-13	NA	NA	NA	NA
Chlorine	4.41E-10	1.30E-09	NA	NA	NA	NA
Chromium	2.58E-10	5.22E-10	NA	NA	NA	NA
Chromium VI	1.52E-10	3.37E-10	NA	NA	NA	NA
Nickel	8.94E-09	2.01E-08	NA	NA	NA	NA
Selenium	8.68E-11	1.92E-10	NA	NA	NA	NA

NC - Not Calculated NA - Not Applicable

Table 48b Estimates of Milk Intake for the Propane Scenario

Chemical	Subsistence Farmer (mg/kg-day)	Subsistence Farmer Child (mg/kg-day)	Subsistence Fisher (mg/kg-day)	Subsistence Fisher Child (mg/kg-day)	Adult Resident (mg/kg-day)	Child Resident (mg/kg-day)
Carcinogens						
Benzene	1.04E-17	3.06E-17	NA	NA	NA	NA
Formaldehyde	7.32E-18	2.15E-17	NA	NA	NA	NA
Arsenic	1.88E-14	4.19E-14	NA	NA	NA	NA
Noncarcinogens						
Benzene	1.04E-17	3.06E-17	NA	NA	NA	NA
Toluene	3.12E-16	9.16E-16	NA	NA	NA	NA
2-Methylnaphthalene	4.85E-15	1.42E-14	NA	NA	NA	NA
Fluoranthene	1.90E-13	5.13E-13	NA	NA	NA	NA
Fluorene	6.91E-17	1.56E-16	NA	NA	NA	NA
Formaldehyde	7.32E-18	2.15E-17	NA	NA	NA	NA
Naphthalene	8.16E-15	2.40E-14	NA	NA	NA	NA
Pyrene	4.94E-14	1.09E-13	NA	NA	NA	NA
Arsenic	1.88E-14	4.19E-14	NA	NA	NA	NA
Nickel	2.11E-11	4.71E-11	NA	NA	NA	NA

NA - Not Applicable

Table 48c Estimates of Milk Intake for the Drill Tower Scenario

Chemical	Subsistence Farmer (mg/kg-day)	Subsistence Farmer Child (mg/kg-day)	Subsistence Fisher (mg/kg-day)	Subsistence Fisher Child (mg/kg-day)	Adult Resident (mg/kg-day)	Child Resident (mg/kg-day)
Carcinogens						
Benzene	2.17E-13	6.39E-13	NA	NA	NA	NA
Benzo(a)pyrene	NC	NC	NA	NA	NA	NA
Benzo[a]anthracene	NC	NC	NA	NA	NA	NA
Benzo[b]flouranthene	NC	NC	NA	NA	NA	NA
Benzo[k]fluoranthene	NC	NC	NA	NA	NA	NA
Chrysene	NC	NC	NA	NA	NA	NA
Dibenz[a,h]anthracene	NC	NC	NA	NA	NA	NA
Indeno[1,2,3-cd]pyrene	NC	NC	NA	NA	NA	NA
Arsenic	4.32E-11	9.60E-11	NA	NA	NA	NA
Chromium VI	6.81E-09	1.50E-08	NA	NA	NA	NA
Noncarcinogens						
Benzaldehyde	6.63E-13	1.95E-12	NA	NA	NA	NA
Benzene	2.17E-13	6.39E-13	NA	NA	NA	NA
Methyl Ethyl Ketone (MEK)	9.02E-15	2.65E-14	NA	NA	NA	NA
Styrene	4.02E-12	1.18E-11	NA	NA	NA	NA
Toluene	3.27E-13	9.61E-13	NA	NA	NA	NA
o-Xylene	4.66E-13	1.37E-12	NA	NA	NA	NA
2-Methylnaphthalene	1.48E-11	4.34E-11	NA	NA	NA	NA
Acenaphthene	NC	NC	NA	NA	NA	NA
Acenaphthylene	NC	NC	NA	NA	NA	NA
Anthracene	NC	NC	NA	NA	NA	NA
Benzo(g,h,i)perylene	NC	NC	NA	NA	NA	NA
Fluoranthene	NC	NC	NA	NA	NA	NA

Table 48c (continued)

Chemical	Subsistence Farmer (mg/kg-day)	Subsistence Farmer Child (mg/kg-day)	Subsistence Fisher (mg/kg-day)	Subsistence Fisher Child (mg/kg-day)	Adult Resident (mg/kg-day)	Child Resident (mg/kg-day)
Fluorene	5.36E-12	1.21E-11	NA	NA	NA	NA
Furans	4.11E-15	1.21E-14	NA	NA	NA	NA
Manganese	NC	NC	NA	NA	NA	NA
Naphthalene	2.16E-10	6.34E-10	NA	NA	NA	NA
Phenol	1.32E-11	3.88E-11	NA	NA	NA	NA
Pyrene	4.58E-09	1.01E-08	NA	NA	NA	NA
n-Hexane	5.25E-15	1.27E-14	NA	NA	NA	NA
Antimony	3.53E-09	8.06E-09	NA	NA	NA	NA
Arsenic	4.32E-11	9.60E-11	NA	NA	NA	NA
Barium	1.24E-06	2.81E-06	NA	NA	NA	NA
Cadmium	4.41E-10	1.04E-09	NA	NA	NA	NA
Chlorine	3.39E-08	9.98E-08	NA	NA	NA	NA
Chromium	9.97E-09	2.06E-08	NA	NA	NA	NA
Chromium VI	6.81E-09	1.50E-08	NA	NA	NA	NA
Nickel	3.47E-09	7.74E-09	NA	NA	NA	NA
Selenium	1.32E-08	2.91E-08	NA	NA	NA	NA
Silver	6.16E-07	1.38E-06	NA	NA	NA	NA
Zinc	2.06E-09	4.77E-09	NA	NA	NA	NA

NC - Not Calculated NA - Not Applicable

Table 49a Estimates of Pork Intake for the ARFF Scenario

Chemical	Subsistence Farmer (mg/kg-day)	Subsistence Farmer Child (mg/kg-day)	Subsistence Fisher (mg/kg-day)	Subsistence Fisher Child (mg/kg-day)	Adult Resident (mg/kg-day)	Child Resident (mg/kg-day)
Carcinogens						
Acetaldehyde	2.54E-15	2.54E-15	NA	NA	NA	NA
Benzene	7.74E-20	7.75E-20	NA	NA	NA	NA
Methylene Chloride	3.71E-19	3.71E-19	NA	NA	NA	NA
Tetrachloroethylene	1.03E-19	1.03E-19	NA	NA	NA	NA
Benzo[a]anthracene	1.39E-13	1.24E-13	NA	NA	NA	NA
Benzo[b]fluoranthene	4.89E-13	4.27E-13	NA	NA	NA	NA
Chrysene	1.68E-13	1.42E-13	NA	NA	NA	NA
Dibenz[a,h]anthracene	1.32E-12	9.96E-13	NA	NA	NA	NA
Formaldehyde	5.51E-20	5.52E-20	NA	NA	NA	NA
Indeno[1,2,3-cd]pyrene	3.29E-11	2.48E-11	NA	NA	NA	NA
2,3,7,8-TCDDioxin Toxicity Equivalents	1.92E-16	1.42E-16	NA	NA	NA	NA
Arsenic	NC	NC	NA	NA	NA	NA
Beryllium	NC	NC	NA	NA	NA	NA
Noncarcinogens						
Acetaldehyde	2.54E-15	2.54E-15	NA	NA	NA	NA
Benzene	7.74E-20	7.75E-20	NA	NA	NA	NA
Ethylbenzene	2.77E-19	2.77E-19	NA	NA	NA	NA
Methyl Chloroform	9.01E-16	9.02E-16	NA	NA	NA	NA
Methylene Chloride	3.71E-19	3.71E-19	NA	NA	NA	NA
Tetrachloroethylene	1.03E-19	1.03E-19	NA	NA	NA	NA
Toluene	1.86E-18	1.86E-18	NA	NA	NA	NA
Vinyl Acetate	6.45E-20	6.45E-20	NA	NA	NA	NA
o-Xylene	7.06E-19	7.06E-19	NA	NA	NA	NA

Table 49a (continued)

Chemical	Subsistence Farmer (mg/kg-day)	Subsistence Farmer Child (mg/kg-day)	Subsistence Fisher (mg/kg-day)	Subsistence Fisher Child (mg/kg-day)	Adult Resident (mg/kg-day)	Child Resident (mg/kg-day)
Acenaphthene	NC	NC	NA	NA	NA	NA
Acenaphthylene	NC	NC	NA	NA	NA	NA
Anthracene	7.50E-16	7.45E-16	NA	NA	NA	NA
Benzo(g,h,i)perylene	NC	NC	NA	NA	NA	NA
Fluoranthene	NC	NC	NA	NA	NA	NA
Fluorene	9.41E-19	7.95E-19	NA	NA	NA	NA
Formaldehyde	5.51E-20	5.52E-20	NA	NA	NA	NA
Manganese	NC	NC	NA	NA	NA	NA
Naphthalene	3.39E-17	3.39E-17	NA	NA	NA	NA
Phenol	6.68E-16	6.69E-16	NA	NA	NA	NA
Pyrene	4.80E-16	3.61E-16	NA	NA	NA	NA
Arsenic	NC	NC	NA	NA	NA	NA
Beryllium	NC	NC	NA	NA	NA	NA
Cadmium	1.37E-14	1.26E-14	NA	NA	NA	NA
Chlorine	NC	NC	NA	NA	NA	NA
Chromium	NC	NC	NA	NA	NA	NA
Chromium VI	NC	NC	NA	NA	NA	NA
Nickel	NC	NC	NA	NA	NA	NA
Selenium	5.77E-12	4.52E-12	NA	NA	NA	NA

NC - Not Calculated NA - Not Applicable

Table 49b Estimates of Pork Intake for the Propane Scenario

Chemical	Subsistence Farmer (mg/kg-day)	Subsistence Farmer Child (mg/kg-day)	Subsistence Fisher (mg/kg-day)	Subsistence Fisher Child (mg/kg-day)	Adult Resident (mg/kg-day)	Child Resident (mg/kg-day)
Carcinogens						
Benzene	5.94E-19	5.94E-19	NA	NA	NA	NA
Formaldehyde	4.08E-19	4.09E-19	NA	NA	NA	NA
Arsenic	NC	NC	NA	NA	NA	NA
Noncarcinogens						
Benzene	5.94E-19	5.94E-19	NA	NA	NA	NA
Toluene	1.82E-17	1.82E-17	NA	NA	NA	NA
2-Methylnaphthalene	1.01E-16	1.02E-16	NA	NA	NA	NA
Fluoranthene	1.66E-14	1.59E-14	NA	NA	NA	NA
Fluorene	1.09E-18	9.17E-19	NA	NA	NA	NA
Formaldehyde	4.08E-19	4.09E-19	NA	NA	NA	NA
Naphthalene	5.12E-16	5.12E-16	NA	NA	NA	NA
Pyrene	5.46E-16	4.10E-16	NA	NA	NA	NA
Arsenic	NC	NC	NA	NA	NA	NA
Nickel	NC	NC	NA	NA	NA	NA

NC - Not calculated NA - Not Applicable

Table 49c Estimates of Pork Intake for the Drill Tower Scenario

Chemical	Subsistence Farmer (mg/kg-day)	Subsistence Farmer Child (mg/kg-day)	Subsistence Fisher (mg/kg-day)	Subsistence Fisher Child (mg/kg-day)	Adult Resident (mg/kg-day)	Child Resident (mg/kg-day)
Carcinogens						
Benzene	1.24E-14	1.24E-14	NA	NA	NA	NA
Benzo(a)pyrene	NC	NC	NA	NA	NA	NA
Benzo[a]anthracene	NC	NC	NA	NA	NA	NA
Benzo[b]flouranthene	NC	NC	NA	NA	NA	NA
Benzo[k]fluoranthene	NC	NC	NA	NA	NA	NA
Chrysene	NC	NC	NA	NA	NA	NA
Dibenz[a,h]anthracene	NC	NC	NA	NA	NA	NA
Indeno[1,2,3-cd]pyrene	NC	NC	NA	NA	NA	NA
Arsenic	NC	NC	NA	NA	NA	NA
Chromium VI	NC	NC	NA	NA	NA	NA
Noncarcinogens						
Benzaldehyde	3.74E-14	3.75E-14	NA	NA	NA	NA
Benzene	1.24E-14	1.24E-14	NA	NA	NA	NA
Methyl Ethyl Ketone (MEK)	5.05E-16	5.06E-16	NA	NA	NA	NA
Styrene	2.41E-13	2.41E-13	NA	NA	NA	NA
Toluene	1.91E-14	1.91E-14	NA	NA	NA	NA
o-Xylene	2.81E-14	2.81E-14	NA	NA	NA	NA
2-Methylnaphthalene	3.09E-13	3.10E-13	NA	NA	NA	NA
Acenaphthene	NC	NC	NA	NA	NA	NA
Acenaphthylene	NC	NC	NA	NA	NA	NA
Anthracene	NC	NC	NA	NA	NA	NA
Benzo(g,h,i)perylene	NC	NC	NA	NA	NA	NA
Fluoranthene	NC	NC	NA	NA	NA	NA

Table 49c (continued)

Chemical	Subsistence Farmer (mg/kg-day)	Subsistence Farmer Child (mg/kg-day)	Subsistence Fisher (mg/kg-day)	Subsistence Fisher Child (mg/kg-day)	Adult Resident (mg/kg-day)	Child Resident (mg/kg-day)
Fluorene	8.24E-14	6.91E-14	NA	NA	NA	NA
Furans	2.29E-16	2.29E-16	NA	NA	NA	NA
Manganese	NC	NC	NA	NA	NA	NA
Naphthalene	1.35E-11	1.35E-11	NA	NA	NA	NA
Phenol	7.45E-13	7.46E-13	NA	NA	NA	NA
Pyrene	4.96E-11	3.73E-11	NA	NA	NA	NA
n-Hexane	1.36E-16	1.26E-16	NA	NA	NA	NA
Antimony	NC	NC	NA	NA	NA	NA
Arsenic	NC	NC	NA	NA	NA	NA
Barium	NC	NC	NA	NA	NA	NA
Cadmium	7.57E-11	6.89E-11	NA	NA	NA	NA
Chlorine	NC	NC	NA	NA	NA	NA
Chromium	NC	NC	NA	NA	NA	NA
Chromium VI	NC	NC	NA	NA	NA	NA
Nickel	NC	NC	NA	NA	NA	NA
Selenium	7.98E-10	6.09E-10	NA	NA	NA	NA
Silver	NC	NC	NA	NA	NA	NA
Zinc	3.74E-11	3.35E-11	NA	NA	NA	NA

NC - Not Calculated NA - Not Applicable

Table 50a Estimates of Poultry Intake for the ARFF Scenario

Chemical	Subsistence Farmer (mg/kg-day)	Subsistence Farmer Child (mg/kg-day)	Subsistence Fisher (mg/kg-day)	Subsistence Fisher Child (mg/kg-day)	Adult Resident (mg/kg-day)	Child Resident (mg/kg-day)
Carcinogens						
Acetaldehyde	8.08E-19	7.50E-19	NA	NA	NA	NA
Benzene	2.51E-21	2.33E-21	NA	NA	NA	NA
Methylene Chloride	1.19E-20	1.11E-20	NA	NA	NA	NA
Tetrachloroethylene	3.34E-21	3.11E-21	NA	NA	NA	NA
Benzo[a]anthracene	NC	NC	NA	NA	NA	NA
Benzo[b]fluoranthene	NC	NC	NA	NA	NA	NA
Chrysene	NC	NC	NA	NA	NA	NA
Dibenz[a,h]anthracene	NC	NC	NA	NA	NA	NA
Formaldehyde	1.76E-21	1.64E-21	NA	NA	NA	NA
Indeno[1,2,3-cd]pyrene	NC	NC	NA	NA	NA	NA
2,3,7,8-TCDDioxin Toxicity Equivalents	2.29E-15	1.56E-15	NA	NA	NA	NA
Arsenic	NC	NC	NA	NA	NA	NA
Beryllium	NC	NC	NA	NA	NA	NA
Noncarcinogens						
Acetaldehyde	8.08E-19	7.50E-19	NA	NA	NA	NA
Benzene	2.51E-21	2.33E-21	NA	NA	NA	NA
Ethylbenzene	9.21E-21	8.56E-21	NA	NA	NA	NA
Methyl Chloroform	2.94E-17	2.73E-17	NA	NA	NA	NA
Methylene Chloride	1.19E-20	1.11E-20	NA	NA	NA	NA
Tetrachloroethylene	3.34E-21	3.11E-21	NA	NA	NA	NA
Toluene	6.11E-20	5.68E-20	NA	NA	NA	NA
Vinyl Acetate	2.06E-21	1.92E-21	NA	NA	NA	NA
o-Xylene	2.36E-20	2.19E-20	NA	NA	NA	NA

Table 50a (continued)

Chemical	Subsistence Farmer (mg/kg-day)	Subsistence Farmer Child (mg/kg-day)	Subsistence Fisher (mg/kg-day)	Subsistence Fisher Child (mg/kg-day)	Adult Resident (mg/kg-day)	Child Resident (mg/kg-day)
Acenaphthene	NC	NC	NA	NA	NA	NA
Acenaphthylene	NC	NC	NA	NA	NA	NA
Anthracene	2.81E-17	2.59E-17	NA	NA	NA	NA
Benzo(g,h,i)perylene	NC	NC	NA	NA	NA	NA
Fluoranthene	NC	NC	NA	NA	NA	NA
Fluorene	1.28E-20	1.19E-20	NA	NA	NA	NA
Formaldehyde	1.76E-21	1.64E-21	NA	NA	NA	NA
Manganese	NC	NC	NA	NA	NA	NA
Naphthalene	1.15E-18	1.07E-18	NA	NA	NA	NA
Phenol	2.15E-17	1.99E-17	NA	NA	NA	NA
Pyrene	1.56E-20	1.45E-20	NA	NA	NA	NA
Arsenic	NC	NC	NA	NA	NA	NA
Beryllium	NC	NC	NA	NA	NA	NA
Cadmium	3.34E-13	2.96E-13	NA	NA	NA	NA
Chlorine	NC	NC	NA	NA	NA	NA
Chromium	NC	NC	NA	NA	NA	NA
Chromium VI	NC	NC	NA	NA	NA	NA
Nickel	NC	NC	NA	NA	NA	NA
Selenium	3.08E-13	2.85E-13	NA	NA	NA	NA

NC - Not Calculated NA - Not Applicable

Table 50b Estimates of Poultry Intake for the Propane Scenario

Chemical	Subsistence Farmer (mg/kg-day)	Subsistence Farmer Child (mg/kg-day)	Subsistence Fisher (mg/kg-day)	Subsistence Fisher Child (mg/kg-day)	Adult Resident (mg/kg-day)	Child Resident (mg/kg-day)
Carcinogens						
Benzene	1.92E-20	1.79E-20	NA	NA	NA	NA
Formaldehyde	1.31E-20	1.21E-20	NA	NA	NA	NA
Arsenic	NC	NC	NA	NA	NA	NA
Noncarcinogens						
Benzene	1.92E-20	1.79E-20	NA	NA	NA	NA
Toluene	5.97E-19	5.55E-19	NA	NA	NA	NA
2-Methylnaphthalene	1.43E-15	1.33E-15	NA	NA	NA	NA
Fluoranthene	6.49E-16	5.78E-16	NA	NA	NA	NA
Fluorene	1.40E-20	1.30E-20	NA	NA	NA	NA
Formaldehyde	1.31E-20	1.21E-20	NA	NA	NA	NA
Naphthalene	1.73E-17	1.61E-17	NA	NA	NA	NA
Pyrene	1.61E-20	1.50E-20	NA	NA	NA	NA
Arsenic	NC	NC	NA	NA	NA	NA
Nickel	NC	NC	NA	NA	NA	NA

NC - Not calculated NA - Not Applicable

Table 50c Estimates of Poultry Intake for the Drill Tower Scenario

Chemical	Subsistence Farmer (mg/kg-day)	Subsistence Farmer Child (mg/kg-day)	Subsistence Fisher (mg/kg-day)	Subsistence Fisher Child (mg/kg-day)	Adult Resident (mg/kg-day)	Child Resident (mg/kg-day)
Carcinogens						
Benzene	4.01E-16	3.73E-16	NA	NA	NA	NA
Benzo(a)pyrene	NC	NC	NA	NA	NA	NA
Benzo[a]anthracene	NC	NC	NA	NA	NA	NA
Benzo[b]flouranthene	NC	NC	NA	NA	NA	NA
Benzo[k]fluoranthene	NC	NC	NA	NA	NA	NA
Chrysene	NC	NC	NA	NA	NA	NA
Dibenz[a,h]anthracene	NC	NC	NA	NA	NA	NA
Indeno[1,2,3-cd]pyrene	NC	NC	NA	NA	NA	NA
Arsenic	NC	NC	NA	NA	NA	NA
Chromium VI	NC	NC	NA	NA	NA	NA
Noncarcinogens						
Benzaldehyde	1.20E-15	1.12E-15	NA	NA	NA	NA
Benzene	4.01E-16	3.73E-16	NA	NA	NA	NA
Methyl Ethyl Ketone (MEK)	1.62E-17	1.50E-17	NA	NA	NA	NA
Styrene	7.95E-15	7.38E-15	NA	NA	NA	NA
Toluene	6.26E-16	5.82E-16	NA	NA	NA	NA
o-Xylene	9.39E-16	8.72E-16	NA	NA	NA	NA
2-Methylnaphthalene	4.35E-12	4.04E-12	NA	NA	NA	NA
Acenaphthene	NC	NC	NA	NA	NA	NA
Acenaphthylene	NC	NC	NA	NA	NA	NA
Anthracene	NC	NC	NA	NA	NA	NA
Benzo(g,h,i)perylene	NC	NC	NA	NA	NA	NA
Fluoranthene	NC	NC	NA	NA	NA	NA

Table 50c (continued)

Chemical	Subsistence Farmer (mg/kg-day)	Subsistence Farmer Child (mg/kg-day)	Subsistence Fisher (mg/kg-day)	Subsistence Fisher Child (mg/kg-day)	Adult Resident (mg/kg-day)	Child Resident (mg/kg-day)
Fluorene	1.05E-15	9.73E-16	NA	NA	NA	NA
Furans	2.96E-15	2.75E-15	NA	NA	NA	NA
Manganese	NC	NC	NA	NA	NA	NA
Naphthalene	4.58E-13	4.26E-13	NA	NA	NA	NA
Phenol	2.39E-14	2.22E-14	NA	NA	NA	NA
Pyrene	1.45E-15	1.34E-15	NA	NA	NA	NA
n-Hexane	1.29E-15	1.20E-15	NA	NA	NA	NA
Antimony	NC	NC	NA	NA	NA	NA
Arsenic	NC	NC	NA	NA	NA	NA
Barium	NC	NC	NA	NA	NA	NA
Cadmium	1.71E-09	1.51E-09	NA	NA	NA	NA
Chlorine	NC	NC	NA	NA	NA	NA
Chromium	NC	NC	NA	NA	NA	NA
Chromium VI	NC	NC	NA	NA	NA	NA
Nickel	NC	NC	NA	NA	NA	NA
Selenium	1.52E-11	1.40E-11	NA	NA	NA	NA
Silver	NC	NC	NA	NA	NA	NA
Zinc	9.32E-11	8.33E-11	NA	NA	NA	NA

NC - Not Calculated NA - Not Applicable

Table 51a Estimates of Egg Intake for the ARFF Scenario

Chemical	Subsistence Farmer (mg/kg-day)	Subsistence Farmer Child (mg/kg-day)	Subsistence Fisher (mg/kg-day)	Subsistence Fisher Child (mg/kg-day)	Adult Resident (mg/kg-day)	Child Resident (mg/kg-day)
Carcinogens						
Acetaldehyde	3.30E-16	3.11E-16	NA	NA	NA	NA
Benzene	1.02E-18	9.62E-19	NA	NA	NA	NA
Methylene Chloride	4.84E-18	4.56E-18	NA	NA	NA	NA
Tetrachloroethylene	1.36E-18	1.28E-18	NA	NA	NA	NA
Benzo[a]anthracene	NC	NC	NA	NA	NA	NA
Benzo[b]fluoranthene	NC	NC	NA	NA	NA	NA
Chrysene	NC	NC	NA	NA	NA	NA
Dibenz[a,h]anthracene	NC	NC	NA	NA	NA	NA
Formaldehyde	7.18E-19	6.77E-19	NA	NA	NA	NA
Indeno[1,2,3-cd]pyrene	NC	NC	NA	NA	NA	NA
2,3,7,8-TCDDioxin Toxicity Equivalents	1.94E-15	1.35E-15	NA	NA	NA	NA
Arsenic	NC	NC	NA	NA	NA	NA
Beryllium	NC	NC	NA	NA	NA	NA
Noncarcinogens						
Acetaldehyde	3.30E-16	3.11E-16	NA	NA	NA	NA
Benzene	1.02E-18	9.62E-19	NA	NA	NA	NA
Ethylbenzene	3.74E-18	3.52E-18	NA	NA	NA	NA
Methyl Chloroform	1.20E-14	1.13E-14	NA	NA	NA	NA
Methylene Chloride	4.84E-18	4.56E-18	NA	NA	NA	NA
Tetrachloroethylene	1.36E-18	1.28E-18	NA	NA	NA	NA
Toluene	2.49E-17	2.34E-17	NA	NA	NA	NA
Vinyl Acetate	8.40E-19	7.91E-19	NA	NA	NA	NA
o-Xylene	9.56E-18	9.01E-18	NA	NA	NA	NA

Table 51a (continued)

Chemical	Subsistence Farmer (mg/kg-day)	Subsistence Farmer Child (mg/kg-day)	Subsistence Fisher (mg/kg-day)	Subsistence Fisher Child (mg/kg-day)	Adult Resident (mg/kg-day)	Child Resident (mg/kg-day)
Acenaphthene	2.01E-16	1.89E-16	NA	NA	NA	NA
Acenaphthylene	1.43E-15	1.34E-15	NA	NA	NA	NA
Anthracene	1.14E-14	1.07E-14	NA	NA	NA	NA
Benzo(g,h,i)perylene	NC	NC	NA	NA	NA	NA
Fluoranthene	NC	NC	NA	NA	NA	NA
Fluorene	5.23E-18	4.92E-18	NA	NA	NA	NA
Formaldehyde	7.18E-19	6.77E-19	NA	NA	NA	NA
Manganese	NC	NC	NA	NA	NA	NA
Naphthalene	4.67E-16	4.40E-16	NA	NA	NA	NA
Phenol	8.73E-15	8.22E-15	NA	NA	NA	NA
Pyrene	6.35E-18	5.98E-18	NA	NA	NA	NA
Arsenic	NC	NC	NA	NA	NA	NA
Beryllium	NC	NC	NA	NA	NA	NA
Cadmium	8.02E-15	7.20E-15	NA	NA	NA	NA
Chlorine	NC	NC	NA	NA	NA	NA
Chromium	NC	NC	NA	NA	NA	NA
Chromium VI	NC	NC	NA	NA	NA	NA
Nickel	NC	NC	NA	NA	NA	NA
Selenium	3.13E-13	2.94E-13	NA	NA	NA	NA

NC - Not Calculated NA - Not Applicable

Table 51b Estimates of Egg Intake for the Propane Scenario

Chemical	Subsistence Farmer (mg/kg-day)	Subsistence Farmer Child (mg/kg-day)	Subsistence Fisher (mg/kg-day)	Subsistence Fisher Child (mg/kg-day)	Adult Resident (mg/kg-day)	Child Resident (mg/kg-day)
Carcinogens						
Benzene	7.83E-18	7.37E-18	NA	NA	NA	NA
Formaldehyde	5.32E-18	5.02E-18	NA	NA	NA	NA
Arsenic	NC	NC	NA	NA	NA	NA
Noncarcinogens						
Benzene	7.83E-18	7.37E-18	NA	NA	NA	NA
Toluene	2.43E-16	2.29E-16	NA	NA	NA	NA
2-Methylnaphthalene	1.45E-15	1.37E-15	NA	NA	NA	NA
Fluoranthene	2.64E-13	2.38E-13	NA	NA	NA	NA
Fluorene	5.72E-18	5.38E-18	NA	NA	NA	NA
Formaldehyde	5.32E-18	5.02E-18	NA	NA	NA	NA
Naphthalene	7.05E-15	6.64E-15	NA	NA	NA	NA
Pyrene	6.58E-18	6.19E-18	NA	NA	NA	NA
Arsenic	NC	NC	NA	NA	NA	NA
Nickel	NC	NC	NA	NA	NA	NA

NC - Not calculated NA - Not Applicable

Table 51c Estimates of Egg Intake for the Drill Tower Scenario

Chemical	Subsistence Farmer (mg/kg-day)	Subsistence Farmer Child (mg/kg-day)	Subsistence Fisher (mg/kg-day)	Subsistence Fisher Child (mg/kg-day)	Adult Resident (mg/kg-day)	Child Resident (mg/kg-day)
Carcinogens						
Benzene	1.64E-13	1.54E-13	NA	NA	NA	NA
Benzo(a)pyrene	NC	NC	NA	NA	NA	NA
Benzo[a]anthracene	NC	NC	NA	NA	NA	NA
Benzo[b]flouranthene	NC	NC	NA	NA	NA	NA
Benzo[k]fluoranthene	NC	NC	NA	NA	NA	NA
Chrysene	NC	NC	NA	NA	NA	NA
Dibenz[a,h]anthracene	NC	NC	NA	NA	NA	NA
Indeno[1,2,3-cd]pyrene	NC	NC	NA	NA	NA	NA
Arsenic	NC	NC	NA	NA	NA	NA
Chromium VI	NC	NC	NA	NA	NA	NA
Noncarcinogens						
Benzaldehyde	4.89E-13	4.61E-13	NA	NA	NA	NA
Benzene	1.64E-13	1.54E-13	NA	NA	NA	NA
Methyl Ethyl Ketone (MEK)	6.56E-15	6.18E-15	NA	NA	NA	NA
Styrene	3.24E-12	3.05E-12	NA	NA	NA	NA
Toluene	2.55E-13	2.40E-13	NA	NA	NA	NA
o-Xylene	3.81E-13	3.59E-13	NA	NA	NA	NA
2-Methylnaphthalene	4.43E-12	4.17E-12	NA	NA	NA	NA
Acenaphthene	NC	NC	NA	NA	NA	NA
Acenaphthylene	NC	NC	NA	NA	NA	NA
Anthracene	NC	NC	NA	NA	NA	NA
Benzo(g,h,i)perylene	NC	NC	NA	NA	NA	NA
Fluoranthene	NC	NC	NA	NA	NA	NA

Table 51c (continued)

Chemical	Subsistence Farmer (mg/kg-day)	Subsistence Farmer Child (mg/kg-day)	Subsistence Fisher (mg/kg-day)	Subsistence Fisher Child (mg/kg-day)	Adult Resident (mg/kg-day)	Child Resident (mg/kg-day)
Fluorene	4.26E-13	4.02E-13	NA	NA	NA	NA
Furans	3.01E-15	2.83E-15	NA	NA	NA	NA
Manganese	NC	NC	NA	NA	NA	NA
Naphthalene	1.87E-10	1.76E-10	NA	NA	NA	NA
Phenol	9.73E-12	9.16E-12	NA	NA	NA	NA
Pyrene	5.90E-13	5.56E-13	NA	NA	NA	NA
n-Hexane	1.31E-15	1.24E-15	NA	NA	NA	NA
Antimony	NC	NC	NA	NA	NA	NA
Arsenic	NC	NC	NA	NA	NA	NA
Barium	NC	NC	NA	NA	NA	NA
Cadmium	4.09E-11	3.68E-11	NA	NA	NA	NA
Chlorine	NC	NC	NA	NA	NA	NA
Chromium	NC	NC	NA	NA	NA	NA
Chromium VI	NC	NC	NA	NA	NA	NA
Nickel	NC	NC	NA	NA	NA	NA
Selenium	1.54E-11	1.45E-11	NA	NA	NA	NA
Silver	NC	NC	NA	NA	NA	NA
Zinc	9.47E-11	8.59E-11	NA	NA	NA	NA

NC - Not Calculated NA - Not Applicable

Table 52a Estimates of Fish Intake for the ARFF Scenario

Chemical	Subsistence Farmer (mg/kg-day)	Subsistence Farmer Child (mg/kg-day)	Subsistence Fisher (mg/kg-day)	Subsistence Fisher Child (mg/kg-day)	Adult Resident (mg/kg-day)	Child Resident (mg/kg-day)
Carcinogens						
Acetaldehyde	NA	NA	2.00E-09	1.30E-09	NA	NA
Benzene	NA	NA	2.37E-16	1.54E-16	NA	NA
Methylene Chloride	NA	NA	2.68E-15	1.74E-15	NA	NA
Tetrachloroethylene	NA	NA	5.97E-17	3.88E-17	NA	NA
Benzo[a]anthracene	NA	NA	2.53E-12	1.64E-12	NA	NA
Benzo[b]fluoranthene	NA	NA	2.48E-12	1.61E-12	NA	NA
Chrysene	NA	NA	4.83E-12	3.13E-12	NA	NA
Dibenz[a,h]anthracene	NA	NA	1.41E-13	9.14E-14	NA	NA
Formaldehyde	NA	NA	1.44E-15	9.34E-16	NA	NA
Indeno[1,2,3-cd]pyrene	NA	NA	1.47E-13	9.54E-14	NA	NA
2,3,7,8-TCDDioxin Toxicity Equivalents	NA	NA	1.09E-18	7.08E-19	NA	NA
Arsenic	NA	NA	4.71E-10	3.06E-10	NA	NA
Beryllium	NA	NA	7.02E-12	4.56E-12	NA	NA
Noncarcinogens						
Acetaldehyde	NA	NA	2.00E-09	1.30E-09	NA	NA
Benzene	NA	NA	2.37E-16	1.54E-16	NA	NA
Ethylbenzene	NA	NA	3.28E-16	2.13E-16	NA	NA
Methyl Chloroform	NA	NA	6.18E-16	4.01E-16	NA	NA
Methylene Chloride	NA	NA	2.68E-15	1.74E-15	NA	NA
Tetrachloroethylene	NA	NA	5.97E-17	3.88E-17	NA	NA
Toluene	NA	NA	3.06E-15	1.98E-15	NA	NA
Vinyl Acetate	NA	NA	7.00E-16	4.54E-16	NA	NA
o-Xylene	NA	NA	7.28E-16	4.72E-16	NA	NA

Table 52a (continued)

Chemical	Subsistence Farmer (mg/kg-day)	Subsistence Farmer Child (mg/kg-day)	Subsistence Fisher (mg/kg-day)	Subsistence Fisher Child (mg/kg-day)	Adult Resident (mg/kg-day)	Child Resident (mg/kg-day)
Acenaphthene	NA	NA	4.35E-14	2.82E-14	NA	NA
Acenaphthylene	NA	NA	3.49E-16	2.26E-16	NA	NA
Anthracene	NA	NA	1.54E-14	9.98E-15	NA	NA
Benzo(g,h,i)perylene	NA	NA	NC	NC	NA	NA
Fluoranthene	NA	NA	1.69E-12	1.10E-12	NA	NA
Fluorene	NA	NA	1.27E-14	8.24E-15	NA	NA
Formaldehyde	NA	NA	1.44E-15	9.34E-16	NA	NA
Manganese	NA	NA	NC	NC	NA	NA
Naphthalene	NA	NA	5.67E-15	3.68E-15	NA	NA
Phenol	NA	NA	2.40E-11	1.56E-11	NA	NA
Pyrene	NA	NA	1.90E-12	1.23E-12	NA	NA
Arsenic	NA	NA	4.71E-10	3.06E-10	NA	NA
Beryllium	NA	NA	7.02E-12	4.56E-12	NA	NA
Cadmium	NA	NA	1.69E-10	1.10E-10	NA	NA
Chlorine	NA	NA	NC	NC	NA	NA
Chromium	NA	NA	2.20E-13	1.43E-13	NA	NA
Chromium VI	NA	NA	1.05E-10	6.84E-11	NA	NA
Nickel	NA	NA	7.73E-08	5.02E-08	NA	NA
Selenium	NA	NA	4.65E-09	3.02E-09	NA	NA

NC - Not Calculated NA - Not Applicable

Table 52b Estimates of Fish Intake for the Propane Scenario

Chemical	Subsistence Farmer (mg/kg-day)	Subsistence Farmer Child (mg/kg-day)	Subsistence Fisher (mg/kg-day)	Subsistence Fisher Child (mg/kg-day)	Adult Resident (mg/kg-day)	Child Resident (mg/kg-day)
Carcinogens						
Benzene	NA	NA	3.39E-15	2.20E-15	NA	NA
Formaldehyde	NA	NA	1.91E-14	1.24E-14	NA	NA
Arsenic	NA	NA	2.70E-12	1.75E-12	NA	NA
Noncarcinogens						
Benzene	NA	NA	3.39E-15	2.20E-15	NA	NA
Toluene	NA	NA	5.59E-14	3.63E-14	NA	NA
2-Methylnaphthalene	NA	NA	1.26E-14	8.17E-15	NA	NA
Fluoranthene	NA	NA	4.51E-12	2.93E-12	NA	NA
Fluorene	NA	NA	2.63E-14	1.71E-14	NA	NA
Formaldehyde	NA	NA	1.91E-14	1.24E-14	NA	NA
Naphthalene	NA	NA	1.61E-13	1.05E-13	NA	NA
Pyrene	NA	NA	3.74E-12	2.42E-12	NA	NA
Arsenic	NA	NA	2.70E-12	1.75E-12	NA	NA
Nickel	NA	NA	2.71E-10	1.76E-10	NA	NA

NA - Not Applicable

Table 52c Estimates of Fish Intake for the Drill Tower Scenario

Chemical	Subsistence Farmer (mg/kg-day)	Subsistence Farmer Child (mg/kg-day)	Subsistence Fisher (mg/kg-day)	Subsistence Fisher Child (mg/kg-day)	Adult Resident (mg/kg-day)	Child Resident (mg/kg-day)
Carcinogens						
Benzene	NA	NA	1.91E-11	1.24E-11	NA	NA
Benzo(a)pyrene	NA	NA	1.84E-08	1.19E-08	NA	NA
Benzo[a]anthracene	NA	NA	1.09E-07	7.08E-08	NA	NA
Benzo[b]flouranthene	NA	NA	4.15E-08	2.69E-08	NA	NA
Benzo[k]fluoranthene	NA	NA	2.43E-08	1.58E-08	NA	NA
Chrysene	NA	NA	2.66E-07	1.73E-07	NA	NA
Dibenz[a,h]anthracene	NA	NA	8.00E-09	5.19E-09	NA	NA
Indeno[1,2,3-cd]pyrene	NA	NA	5.72E-09	3.71E-09	NA	NA
Arsenic	NA	NA	5.55E-10	3.60E-10	NA	NA
Chromium VI	NA	NA	7.71E-10	5.00E-10	NA	NA
Noncarcinogens						
Benzaldehyde	NA	NA	7.31E-11	4.75E-11	NA	NA
Benzene	NA	NA	1.91E-11	1.24E-11	NA	NA
Methyl Ethyl Ketone (MEK)	NA	NA	5.91E-12	3.84E-12	NA	NA
Styrene	NA	NA	2.90E-11	1.88E-11	NA	NA
Toluene	NA	NA	1.58E-11	1.02E-11	NA	NA
o-Xylene	NA	NA	1.47E-11	9.51E-12	NA	NA
2-Methylnaphthalene	NA	NA	1.03E-11	6.70E-12	NA	NA
Acenaphthene	NA	NA	1.86E-10	1.21E-10	NA	NA
Acenaphthylene	NA	NA	1.62E-10	1.05E-10	NA	NA
Anthracene	NA	NA	8.25E-10	5.35E-10	NA	NA
Benzo(g,h,i)perylene	NA	NA	NC	NC	NA	NA
Fluoranthene	NA	NA	2.07E-07	1.35E-07	NA	NA

Table 52c (continued)

Chemical	Subsistence Farmer (mg/kg-day)	Subsistence Farmer Child (mg/kg-day)	Subsistence Fisher (mg/kg-day)	Subsistence Fisher Child (mg/kg-day)	Adult Resident (mg/kg-day)	Child Resident (mg/kg-day)
Fluorene	NA	NA	5.28E-10	3.42E-10	NA	NA
Furans	NA	NA	5.20E-13	3.37E-13	NA	NA
Manganese	NA	NA	NC	NC	NA	NA
Naphthalene	NA	NA	1.15E-09	7.44E-10	NA	NA
Phenol	NA	NA	1.33E-08	8.62E-09	NA	NA
Pyrene	NA	NA	9.00E-08	5.84E-08	NA	NA
n-Hexane	NA	NA	7.16E-14	4.65E-14	NA	NA
Antimony	NA	NA	3.34E-08	2.17E-08	NA	NA
Arsenic	NA	NA	5.55E-10	3.60E-10	NA	NA
Barium	NA	NA	5.89E-05	3.82E-05	NA	NA
Cadmium	NA	NA	2.12E-07	1.37E-07	NA	NA
Chlorine	NA	NA	NC	NC	NA	NA
Chromium	NA	NA	1.61E-12	1.04E-12	NA	NA
Chromium VI	NA	NA	7.71E-10	5.00E-10	NA	NA
Nickel	NA	NA	4.99E-09	3.24E-09	NA	NA
Selenium	NA	NA	5.60E-08	3.63E-08	NA	NA
Silver	NA	NA	7.30E-07	4.74E-07	NA	NA
Zinc	NA	NA	2.15E-06	1.40E-06	NA	NA

NC - Not Calculated NA - Not Applicable

Table 53a Estimates of Water Intake for the ARFF Scenario

Chemical	Subsistence Farmer (mg/kg-day)	Subsistence Farmer Child (mg/kg-day)	Subsistence Fisher (mg/kg-day)	Subsistence Fisher Child (mg/kg-day)	Adult Resident (mg/kg-day)	Child Resident (mg/kg-day)
Carcinogens						
Acetaldehyde	6.45E-08	1.91E-07	8.54E-08	1.91E-07	8.54E-08	1.91E-07
Benzene	1.63E-16	3.65E-16	1.63E-16	3.65E-16	1.63E-16	3.65E-16
Methylene Chloride	8.63E-15	1.93E-14	8.63E-15	1.93E-14	8.63E-15	1.93E-14
Tetrachloroethylene	2.02E-17	4.51E-17	2.02E-17	4.51E-17	2.02E-17	4.51E-17
Benzo[a]anthracene	7.64E-15	1.90E-14	8.49E-15	1.90E-14	8.49E-15	1.90E-14
Benzo[b]fluoranthene	3.85E-15	9.52E-15	4.26E-15	9.52E-15	4.26E-15	9.52E-15
Chrysene	1.24E-14	3.06E-14	1.37E-14	3.06E-14	1.37E-14	3.06E-14
Dibenz[a,h]anthracene	1.64E-16	4.20E-16	1.88E-16	4.20E-16	1.88E-16	4.20E-16
Formaldehyde	7.34E-14	1.64E-13	7.34E-14	1.64E-13	7.34E-14	1.64E-13
Indeno[1,2,3-cd]pyrene	1.64E-16	4.29E-16	1.92E-16	4.29E-16	1.92E-16	4.29E-16
2,3,7,8-TCDDioxin Toxicity Equivalents	4.83E-19	1.06E-18	4.76E-19	1.06E-18	4.76E-19	1.06E-18
Arsenic	3.24E-10	8.99E-10	4.03E-10	8.99E-10	4.03E-10	8.99E-10
Beryllium	2.92E-12	6.39E-12	2.86E-12	6.39E-12	2.86E-12	6.39E-12
Noncarcinogens						
Acetaldehyde	6.45E-08	1.91E-07	8.54E-08	1.91E-07	8.54E-08	1.91E-07
Benzene	1.63E-16	3.65E-16	1.63E-16	3.65E-16	1.63E-16	3.65E-16
Ethylbenzene	4.03E-17	9.00E-17	4.03E-17	9.00E-17	4.03E-17	9.00E-17
Methyl Chloroform	2.59E-16	5.78E-16	2.59E-16	5.78E-16	2.59E-16	5.78E-16
Methylene Chloride	8.63E-15	1.93E-14	8.63E-15	1.93E-14	8.63E-15	1.93E-14
Tetrachloroethylene	2.02E-17	4.51E-17	2.02E-17	4.51E-17	2.02E-17	4.51E-17
Toluene	8.33E-16	1.86E-15	8.34E-16	1.86E-15	8.34E-16	1.86E-15
Vinyl Acetate	5.98E-15	1.34E-14	5.98E-15	1.34E-14	5.98E-15	1.34E-14
o-Xylene	8.82E-17	1.97E-16	8.82E-17	1.97E-16	8.82E-17	1.97E-16

Table 53a (continued)

Chemical	Subsistence Farmer (mg/kg-day)	Subsistence Farmer Child (mg/kg-day)	Subsistence Fisher (mg/kg-day)	Subsistence Fisher Child (mg/kg-day)	Adult Resident (mg/kg-day)	Child Resident (mg/kg-day)
Acenaphthene	1.23E-15	2.74E-15	1.23E-15	2.74E-15	1.23E-15	2.74E-15
Acenaphthylene	1.00E-16	2.29E-16	1.03E-16	2.29E-16	1.03E-16	2.29E-16
Anthracene	9.71E-17	2.26E-16	1.01E-16	2.26E-16	1.01E-16	2.26E-16
Benzo(g,h,i)perylene	4.16E-15	7.60E-15	3.40E-15	7.60E-15	3.40E-15	7.60E-15
Fluoranthene	1.67E-15	4.11E-15	1.84E-15	4.11E-15	1.84E-15	4.11E-15
Fluorene	1.81E-16	4.04E-16	1.81E-16	4.04E-16	1.81E-16	4.04E-16
Formaldehyde	7.34E-14	1.64E-13	7.34E-14	1.64E-13	7.34E-14	1.64E-13
Manganese	NC	NC	NC	NC	NC	NC
Naphthalene	4.49E-16	1.01E-15	4.51E-16	1.01E-15	4.51E-16	1.01E-15
Phenol	4.59E-11	1.17E-10	5.26E-11	1.17E-10	5.26E-11	1.17E-10
Pyrene	2.73E-15	6.09E-15	2.73E-15	6.09E-15	2.73E-15	6.09E-15
Arsenic	3.24E-10	8.99E-10	4.03E-10	8.99E-10	4.03E-10	8.99E-10
Beryllium	2.92E-12	6.39E-12	2.86E-12	6.39E-12	2.86E-12	6.39E-12
Cadmium	9.49E-12	2.59E-11	1.16E-11	2.59E-11	1.16E-11	2.59E-11
Chlorine	5.99E-05	1.77E-04	7.94E-05	1.77E-04	7.94E-05	1.77E-04
Chromium	2.44E-14	4.41E-14	1.98E-14	4.41E-14	1.98E-14	4.41E-14
Chromium VI	4.82E-10	1.34E-09	6.01E-10	1.34E-09	6.01E-10	1.34E-09
Nickel	1.38E-08	3.79E-08	1.69E-08	3.79E-08	1.69E-08	3.79E-08
Selenium	4.93E-10	1.38E-09	6.16E-10	1.38E-09	6.16E-10	1.38E-09

NC - Not Calculated NA - Not Applicable

Table 53b Estimates of Water Intake for the Propane Scenario

Chemical	Subsistence Farmer (mg/kg-day)	Subsistence Farmer Child (mg/kg-day)	Subsistence Fisher (mg/kg-day)	Subsistence Fisher Child (mg/kg-day)	Adult Resident (mg/kg-day)	Child Resident (mg/kg-day)
Carcinogens						
Benzene	2.34E-15	5.22E-15	2.34E-15	5.22E-15	2.34E-15	5.22E-15
Formaldehyde	9.73E-13	2.17E-12	9.74E-13	2.17E-12	9.74E-13	2.17E-12
Arsenic	1.86E-12	5.15E-12	2.31E-12	5.15E-12	2.31E-12	5.15E-12
Noncarcinogens						
Benzene	2.34E-15	5.22E-15	2.34E-15	5.22E-15	2.34E-15	5.22E-15
Toluene	1.52E-14	3.41E-14	1.52E-14	3.41E-14	1.52E-14	3.41E-14
2-Methylnaphthalene	5.41E-16	1.21E-15	5.44E-16	1.21E-15	5.44E-16	1.21E-15
Fluoranthene	4.47E-15	1.10E-14	4.91E-15	1.10E-14	4.91E-15	1.10E-14
Fluorene	3.75E-16	8.37E-16	3.75E-16	8.37E-16	3.75E-16	8.37E-16
Formaldehyde	9.73E-13	2.17E-12	9.74E-13	2.17E-12	9.74E-13	2.17E-12
Naphthalene	1.28E-14	2.87E-14	1.28E-14	2.87E-14	1.28E-14	2.87E-14
Pyrene	5.37E-15	1.20E-14	5.37E-15	1.20E-14	5.37E-15	1.20E-14
Arsenic	1.86E-12	5.15E-12	2.31E-12	5.15E-12	2.31E-12	5.15E-12
Nickel	4.84E-11	1.32E-10	5.93E-11	1.32E-10	5.93E-11	1.32E-10

Table 53c Estimates of Water Intake for the Drill Tower Scenario

Chemical	Subsistence Farmer (mg/kg-day)	Subsistence Farmer Child (mg/kg-day)	Subsistence Fisher (mg/kg-day)	Subsistence Fisher Child (mg/kg-day)	Adult Resident (mg/kg-day)	Child Resident (mg/kg-day)
Carcinogens						
Benzene	1.32E-11	2.94E-11	1.32E-11	2.94E-11	1.32E-11	2.94E-11
Benzo(a)pyrene	2.84E-11	7.04E-11	3.15E-11	7.04E-11	3.15E-11	7.04E-11
Benzo[a]anthracene	3.30E-10	8.17E-10	3.66E-10	8.17E-10	3.66E-10	8.17E-10
Benzo[b]flouranthene	6.46E-11	1.59E-10	7.13E-11	1.59E-10	7.13E-11	1.59E-10
Benzo[k]fluoranthene	3.97E-11	9.32E-11	4.17E-11	9.32E-11	4.17E-11	9.32E-11
Chrysene	6.83E-10	1.69E-09	7.55E-10	1.69E-09	7.55E-10	1.69E-09
Dibenz[a,h]anthracene	9.23E-12	2.39E-11	1.07E-11	2.39E-11	1.07E-11	2.39E-11
Indeno[1,2,3-cd]pyrene	6.33E-12	1.67E-11	7.46E-12	1.67E-11	7.46E-12	1.67E-11
Arsenic	3.82E-10	1.06E-09	4.75E-10	1.06E-09	4.75E-10	1.06E-09
Chromium VI	3.53E-09	9.81E-09	4.39E-09	9.81E-09	4.39E-09	9.81E-09
Noncarcinogens						
Benzaldehyde	1.58E-10	3.58E-10	1.60E-10	3.58E-10	1.60E-10	3.58E-10
Benzene	1.32E-11	2.94E-11	1.32E-11	2.94E-11	1.32E-11	2.94E-11
Methyl Ethyl Ketone (MEK)	1.05E-10	2.35E-10	1.05E-10	2.35E-10	1.05E-10	2.35E-10
Styrene	4.99E-12	1.12E-11	4.99E-12	1.12E-11	4.99E-12	1.12E-11
Toluene	4.30E-12	9.61E-12	4.31E-12	9.61E-12	4.31E-12	9.61E-12
o-Xylene	1.78E-12	3.97E-12	1.78E-12	3.97E-12	1.78E-12	3.97E-12
2-Methylnaphthalene	4.44E-13	9.96E-13	4.46E-13	9.96E-13	4.46E-13	9.96E-13
Acenaphthene	5.25E-12	1.17E-11	5.25E-12	1.17E-11	5.25E-12	1.17E-11
Acenaphthylene	4.66E-11	1.06E-10	4.75E-11	1.06E-10	4.75E-11	1.06E-10
Anthracene	5.21E-12	1.21E-11	5.42E-12	1.21E-11	5.42E-12	1.21E-11
Benzo(g,h,i)perylene	1.05E-10	1.93E-10	8.62E-11	1.93E-10	8.62E-11	1.93E-10
Fluoranthene	2.05E-10	5.04E-10	2.26E-10	5.04E-10	2.26E-10	5.04E-10

Table 53c (continued)

Chemical	Subsistence Farmer (mg/kg-day)	Subsistence Farmer Child (mg/kg-day)	Subsistence Fisher (mg/kg-day)	Subsistence Fisher Child (mg/kg-day)	Adult Resident (mg/kg-day)	Child Resident (mg/kg-day)
Fluorene	7.52E-12	1.68E-11	7.52E-12	1.68E-11	7.52E-12	1.68E-11
Furans	1.40E-12	3.12E-12	1.40E-12	3.12E-12	1.40E-12	3.12E-12
Manganese	NC	NC	NC	NC	NC	NC
Naphthalene	9.09E-11	2.04E-10	9.12E-11	2.04E-10	9.12E-11	2.04E-10
Phenol	2.55E-08	6.50E-08	2.91E-08	6.50E-08	2.91E-08	6.50E-08
Pyrene	1.29E-10	2.89E-10	1.29E-10	2.89E-10	1.29E-10	2.89E-10
n-Hexane	6.58E-15	1.47E-14	6.58E-15	1.47E-14	6.58E-15	1.47E-14
Antimony	1.16E-08	3.19E-08	1.43E-08	3.19E-08	1.43E-08	3.19E-08
Arsenic	3.82E-10	1.06E-09	4.75E-10	1.06E-09	4.75E-10	1.06E-09
Barium	1.29E-06	3.55E-06	1.59E-06	3.55E-06	1.59E-06	3.55E-06
Cadmium	1.19E-08	3.23E-08	1.45E-08	3.23E-08	1.45E-08	3.23E-08
Chlorine	2.21E-03	6.57E-03	2.94E-03	6.57E-03	2.94E-03	6.57E-03
Chromium	1.78E-13	3.23E-13	1.44E-13	3.23E-13	1.44E-13	3.23E-13
Chromium VI	3.53E-09	9.81E-09	4.39E-09	9.81E-09	4.39E-09	9.81E-09
Nickel	8.93E-10	2.44E-09	1.09E-09	2.44E-09	1.09E-09	2.44E-09
Selenium	5.93E-09	1.66E-08	7.42E-09	1.66E-08	7.42E-09	1.66E-08
Silver	4.90E-08	1.37E-07	6.12E-08	1.37E-07	6.12E-08	1.37E-07
Zinc	1.46E-08	3.99E-08	1.78E-08	3.99E-08	1.78E-08	3.99E-08

NC - Not Calculated

Table 54a Estimates of Intake by the Subsistence Farmer for the ARRF Scenario

Chemical	Ingestion of: Surface Water	Soil	Vegetation	Beef	Milk	Pork	Poultry	Egg	Fish	Total
Carcinogens										
Acetaldehyde	6.45E-08	1.53E-14	1.50E-09	1.13E-16	4.54E-16	2.54E-15	8.08E-19	3.30E-16	NA	6.60E-08
Benzene	1.63E-16	4.57E-18	1.82E-14	3.39E-19	1.36E-18	7.74E-20	2.51E-21	1.02E-18	NA	1.84E-14
Methylene Chloride	8.63E-15	5.27E-17	6.71E-13	1.64E-18	6.60E-18	3.71E-19	1.19E-20	4.84E-18	NA	6.80E-13
Tetrachloroethylene	2.02E-17	3.96E-18	7.20E-15	4.45E-19	1.76E-18	1.03E-19	3.34E-21	1.36E-18	NA	7.23E-15
Benzo[a]anthracene	7.64E-15	4.75E-14	6.98E-13	NC	NC	NC	NC	NC	NA	7.53E-13
Benzo[b]flouranthene	3.85E-15	4.62E-14	3.91E-13	NC	NC	NC	NC	NC	NA	4.41E-13
Chrysene	1.24E-14	4.24E-14	5.98E-13	NC	NC	NC	NC	NC	NA	6.53E-13
Dibenz[a,h]anthracene	1.64E-16	1.72E-15	1.17E-13	NC	NC	NC	NC	NC	NA	1.19E-13
Formaldehyde	7.34E-14	1.91E-17	7.69E-13	2.45E-19	9.87E-19	5.51E-20	1.76E-21	7.18E-19	NA	8.42E-13
Indeno[1,2,3-cd]pyrene	1.64E-16	3.88E-15	1.10E-12	NC	NC	NC	NC	NC	NA	1.10E-12
2,3,7,8-TCDDioxin Toxicity Equivalents	4.83E-19	2.19E-17	9.88E-17	1.64E-15	3.06E-15	1.92E-16	2.29E-15	1.94E-15	NA	9.24E-15
Arsenic	3.24E-10	4.63E-13	1.26E-11	9.16E-12	3.02E-12	NC	NC	NC	NA	3.49E-10
Beryllium	2.92E-12	8.74E-13	3.40E-12	1.21E-12	1.07E-14	NC	NC	NC	NA	8.42E-12
Noncarcinogens										
Acetaldehyde	6.45E-08	1.53E-14	1.50E-09	1.13E-16	4.54E-16	2.54E-15	8.08E-19	3.30E-16	NA	6.60E-08
Benzene	1.63E-16	4.57E-18	1.82E-14	3.39E-19	1.36E-18	7.74E-20	2.51E-21	1.02E-18	NA	1.84E-14
Ethylbenzene	4.03E-17	5.72E-18	2.01E-14	1.18E-18	4.58E-18	2.77E-19	9.21E-21	3.74E-18	NA	2.01E-14
Methyl Chloroform	2.59E-16	3.98E-14	3.74E-11	3.92E-15	1.56E-14	9.01E-16	2.94E-17	1.20E-14	NA	3.74E-11
Methylene Chloride	8.63E-15	5.27E-17	6.71E-13	1.64E-18	6.60E-18	3.71E-19	1.19E-20	4.84E-18	NA	6.80E-13
Tetrachloroethylene	2.02E-17	3.96E-18	7.20E-15	4.45E-19	1.76E-18	1.03E-19	3.34E-21	1.36E-18	NA	7.23E-15
Toluene	8.33E-16	6.36E-17	1.88E-13	8.11E-18	3.19E-17	1.86E-18	6.11E-20	2.49E-17	NA	1.89E-13
Vinyl Acetate	5.98E-15	1.58E-17	3.69E-13	2.87E-19	1.15E-18	6.45E-20	2.06E-21	8.40E-19	NA	3.75E-13
o-Xylene	8.82E-17	1.45E-17	4.42E-14	3.02E-18	1.17E-17	7.06E-19	2.36E-20	9.56E-18	NA	4.43E-14
p-Xylene	2.00E-15	3.09E-21	7.80E-17	9.21E-20	3.28E-19	3.74E-21	5.26E-24	2.15E-21	NA	2.08E-15

Table 54a (continued)

Chemical	Ingestion of: Surface Water	Soil	Vegetation	Beef	Milk	Pork	Poultry	Egg	Fish	Total
2-Methylnaphthalene	2.45E-17	8.90E-17	1.94E-14	1.10E-17	4.13E-16	8.65E-18	1.22E-16	1.24E-16	NA	2.02E-14
Acenaphthene	1.23E-15	1.03E-16	7.17E-14	9.12E-17	3.30E-16	1.53E-17	4.93E-19	2.01E-16	NA	7.37E-14
Acenaphthylene	1.00E-16	7.56E-16	1.30E-13	1.21E-16	4.43E-15	9.80E-17	1.40E-15	1.43E-15	NA	1.38E-13
Anthracene	9.71E-17	2.66E-15	1.71E-13	2.69E-15	9.10E-15	7.50E-16	2.81E-17	1.14E-14	NA	1.98E-13
Benzo(g,h,i)perylene	4.16E-15	5.07E-14	2.04E-13	NC	NC	NC	NC	NC	NA	2.59E-13
Fluoranthene	1.67E-15	1.42E-14	4.41E-13	NC	NC	NC	NC	NC	NA	4.57E-13
Fluorene	1.81E-16	1.97E-18	2.04E-16	1.65E-17	5.84E-17	9.41E-19	1.28E-20	5.23E-18	NA	4.68E-16
Formaldehyde	7.34E-14	1.91E-17	7.69E-13	2.45E-19	9.87E-19	5.51E-20	1.76E-21	7.18E-19	NA	8.42E-13
Manganese	NC	2.18E-15	2.25E-11	NC	NC	NC	NC	NC	NA	2.25E-11
Naphthalene	4.49E-16	5.28E-16	5.66E-13	1.41E-16	5.40E-16	3.39E-17	1.15E-18	4.67E-16	NA	5.69E-13
Phenol	4.59E-11	7.64E-14	5.76E-10	2.96E-15	1.19E-14	6.68E-16	2.15E-17	8.73E-15	NA	6.22E-10
Pyrene	2.73E-15	5.74E-19	1.56E-15	1.23E-14	4.37E-14	4.80E-16	1.56E-20	6.35E-18	NA	6.08E-14
Arsenic	3.24E-10	4.63E-13	1.26E-11	9.16E-12	3.02E-12	NC	NC	NC	NA	3.49E-10
Beryllium	2.92E-12	8.74E-13	3.40E-12	1.21E-12	1.07E-14	NC	NC	NC	NA	8.42E-12
Cadmium	9.49E-12	7.79E-14	7.85E-12	1.05E-13	6.52E-14	1.37E-14	3.34E-13	8.02E-15	NA	1.79E-11
Chlorine	5.99E-05	1.25E-11	NC	3.98E-10	4.41E-10	NC	NC	NC	NA	5.99E-05
Chromium	2.44E-14	2.20E-11	9.73E-11	1.06E-10	2.58E-10	NC	NC	NC	NA	4.84E-10
Chromium VI	4.82E-10	3.09E-13	2.33E-11	5.04E-11	1.52E-10	NC	NC	NC	NA	7.09E-10
Nickel	1.38E-08	8.79E-11	2.43E-09	4.89E-09	8.94E-09	NC	NC	NC	NA	3.02E-08
Selenium	4.93E-10	2.54E-14	3.61E-12	3.02E-12	8.68E-11	5.77E-12	3.08E-13	3.13E-13	NA	5.93E-10

NC - Not Calculated NA - Not Applicable

Table 54b Estimates of Intake by the Subsistence Farmer Child for the ARRF Scenario

Chemical	Ingestion of: Surface Water	Soil	Vegetation	Beef	Milk	Pork	Poultry	Egg	Fish	Total
Carcinogens										
Acetaldehyde	1.91E-07	1.90E-13	3.01E-09	6.72E-17	1.33E-15	2.54E-15	7.50E-19	3.11E-16	NA	1.94E-07
Benzene	3.65E-16	5.69E-17	3.65E-14	2.02E-19	3.99E-18	7.75E-20	2.33E-21	9.62E-19	NA	3.69E-14
Methylene Chloride	1.93E-14	6.56E-16	1.34E-12	9.80E-19	1.94E-17	3.71E-19	1.11E-20	4.56E-18	NA	1.36E-12
Tetrachloroethylene	4.51E-17	4.93E-17	1.42E-14	2.65E-19	5.18E-18	1.03E-19	3.11E-21	1.28E-18	NA	1.43E-14
Benzo[a]anthracene	1.90E-14	5.42E-13	1.19E-12	NC	NC	NC	NC	NC	NA	1.04E-11
Benzo[b]flouranthene	9.52E-15	5.30E-13	6.68E-13	NC	NC	NC	NC	NC	NA	4.39E-11
Chrysene	3.06E-14	4.67E-13	9.79E-13	NC	NC	NC	NC	NC	NA	1.59E-11
Dibenz[a,h]anthracene	4.20E-16	1.90E-14	1.66E-13	NC	NC	NC	NC	NC	NA	2.76E-10
Formaldehyde	1.64E-13	2.38E-16	1.53E-12	1.46E-19	2.90E-18	5.52E-20	1.64E-21	6.77E-19	NA	1.70E-12
Indeno[1,2,3-cd]pyrene	4.29E-16	4.38E-14	1.55E-12	NC	NC	NC	NC	NC	NA	6.95E-09
2,3,7,8-TCDDioxin Toxicity Equivalents	1.06E-18	2.01E-16	1.38E-16	7.29E-16	6.73E-15	1.42E-16	1.56E-15	1.35E-15	NA	1.09E-14
Arsenic	8.99E-10	5.66E-12	1.86E-11	4.19E-12	6.79E-12	NC	NC	NC	NA	9.34E-10
Beryllium	6.39E-12	7.98E-12	4.68E-12	5.39E-13	2.34E-14	NC	NC	NC	NA	1.96E-11
Noncarcinogens										
Acetaldehyde	1.91E-07	1.90E-13	3.01E-09	6.72E-17	1.33E-15	2.54E-15	7.50E-19	3.11E-16	NA	1.94E-07
Benzene	3.65E-16	5.69E-17	3.65E-14	2.02E-19	3.99E-18	7.75E-20	2.33E-21	9.62E-19	NA	3.69E-14
Ethylbenzene	9.00E-17	7.12E-17	4.15E-14	7.03E-19	1.34E-17	2.77E-19	8.56E-21	3.52E-18	NA	4.17E-14
Methyl Chloroform	5.78E-16	4.95E-13	6.81E-11	2.34E-15	4.58E-14	9.02E-16	2.73E-17	1.13E-14	NA	6.87E-11
Methylene Chloride	1.93E-14	6.56E-16	1.34E-12	9.80E-19	1.94E-17	3.71E-19	1.11E-20	4.56E-18	NA	1.36E-12
Tetrachloroethylene	4.51E-17	4.93E-17	1.42E-14	2.65E-19	5.18E-18	1.03E-19	3.11E-21	1.28E-18	NA	1.43E-14
Toluene	1.86E-15	7.92E-16	3.83E-13	4.83E-18	9.37E-17	1.86E-18	5.68E-20	2.34E-17	NA	3.86E-13
Vinyl Acetate	1.34E-14	1.97E-16	7.33E-13	1.71E-19	3.38E-18	6.45E-20	1.92E-21	7.91E-19	NA	7.47E-13
o-Xylene	1.97E-16	1.80E-16	9.12E-14	1.79E-18	3.42E-17	7.06E-19	2.19E-20	9.01E-18	NA	9.16E-14
p-Xylene	4.48E-15	3.85E-20	1.14E-16	4.13E-20	7.24E-19	2.85E-21	4.88E-24	2.03E-21	NA	4.59E-15

Table 54b (continued)

Chemical	Ingestion of: Surface Water	Soil	Vegetation	Beef	Milk	Pork	Poultry	Egg	Fish	Total
2-Methylnaphthalene	5.49E-17	1.11E-15	3.67E-14	6.58E-18	1.21E-15	8.65E-18	1.13E-16	1.16E-16	NA	3.93E-14
Acenaphthene	2.74E-15	1.28E-15	1.44E-13	4.88E-17	8.70E-16	1.50E-17	4.58E-19	1.89E-16	NA	1.49E-13
Acenaphthylene	2.29E-16	9.39E-15	2.46E-13	7.21E-17	1.30E-14	9.80E-17	1.30E-15	1.34E-15	NA	2.71E-13
Anthracene	2.26E-16	3.29E-14	3.11E-13	1.59E-15	2.65E-14	7.45E-16	2.59E-17	1.07E-14	NA	3.84E-13
Benzo(g,h,i)perylene	7.60E-15	3.84E-13	2.37E-13	NC	NC	NC	NC	NC	NA	9.53E-11
Fluoranthene	4.11E-15	1.69E-13	7.85E-13	NC	NC	NC	NC	NC	NA	1.51E-12
Fluorene	4.04E-16	2.45E-17	3.69E-16	7.57E-18	1.32E-16	7.95E-19	1.19E-20	4.92E-18	NA	9.44E-16
Formaldehyde	1.64E-13	2.38E-16	1.53E-12	1.46E-19	2.90E-18	5.52E-20	1.64E-21	6.77E-19	NA	1.70E-12
Manganese	NC	2.71E-14	3.15E-11	NC	NC	NC	NC	NC	NA	3.16E-11
Naphthalene	1.01E-15	6.57E-15	1.15E-12	8.40E-17	1.59E-15	3.39E-17	1.07E-18	4.40E-16	NA	1.16E-12
Phenol	1.17E-10	9.50E-13	1.14E-09	1.77E-15	3.48E-14	6.69E-16	1.99E-17	8.22E-15	NA	1.26E-09
Pyrene	6.09E-15	7.14E-18	2.19E-15	5.51E-15	9.64E-14	3.61E-16	1.45E-20	5.98E-18	NA	1.11E-13
Arsenic	8.99E-10	5.66E-12	1.86E-11	4.19E-12	6.79E-12	NC	NC	NC	NA	9.34E-10
Beryllium	6.39E-12	7.98E-12	4.68E-12	5.39E-13	2.34E-14	NC	NC	NC	NA	1.96E-11
Cadmium	2.59E-11	9.25E-13	1.33E-11	5.14E-14	1.58E-13	1.26E-14	2.96E-13	7.20E-15	NA	4.06E-11
Chlorine	1.77E-04	1.55E-10	NC	2.37E-10	1.30E-09	NC	NC	NC	NA	1.77E-04
Chromium	4.41E-14	1.64E-10	1.15E-10	4.25E-11	5.22E-10	NC	NC	NC	NA	8.44E-10
Chromium VI	1.34E-09	3.80E-12	3.31E-11	2.26E-11	3.37E-10	NC	NC	NC	NA	1.74E-09
Nickel	3.79E-08	1.05E-09	3.61E-09	2.23E-09	2.01E-08	NC	NC	NC	NA	6.48E-08
Selenium	1.38E-09	3.15E-13	5.22E-12	1.36E-12	1.92E-10	4.52E-12	2.85E-13	2.94E-13	NA	1.58E-09

NC - Not Calculated NA - Not Applicable

Table 54c Estimates of Intake by the Subsistence Fisher for the ARFF Scenario

Chemical	Ingestion of: Surface Water	Soil	Vegetation	Beef	Milk	Pork	Poultry	Egg	Fish	Total
Carcinogens										
Acetaldehyde	8.54E-08	2.04E-14	5.00E-10	NA	NA	NA	NA	NA	2.00E-09	8.79E-08
Benzene	1.63E-16	6.10E-18	6.08E-15	NA	NA	NA	NA	NA	2.37E-16	6.48E-15
Methylene Chloride	8.63E-15	7.03E-17	2.24E-13	NA	NA	NA	NA	NA	2.68E-15	2.35E-13
Tetrachloroethylene	2.02E-17	5.28E-18	2.40E-15	NA	NA	NA	NA	NA	5.97E-17	2.49E-15
Benzo[a]anthracene	8.49E-15	5.81E-14	2.13E-13	NA	NA	NA	NA	NA	2.53E-12	2.81E-12
Benzo[b]flouranthene	4.26E-15	5.68E-14	1.18E-13	NA	NA	NA	NA	NA	2.48E-12	2.66E-12
Chrysene	1.37E-14	5.00E-14	1.75E-13	NA	NA	NA	NA	NA	4.83E-12	5.07E-12
Dibenz[a,h]anthracene	1.88E-16	2.03E-15	2.95E-14	NA	NA	NA	NA	NA	1.41E-13	1.73E-13
Formaldehyde	7.34E-14	2.55E-17	2.56E-13	NA	NA	NA	NA	NA	1.44E-15	3.31E-13
Indeno[1,2,3-cd]pyrene	1.92E-16	4.69E-15	2.77E-13	NA	NA	NA	NA	NA	1.47E-13	4.29E-13
2,3,7,8-TCDDioxin Toxicity Equivalents	4.76E-19	2.15E-17	2.44E-17	NA	NA	NA	NA	NA	1.09E-18	4.74E-17
Arsenic	4.03E-10	6.06E-13	3.32E-12	NA	NA	NA	NA	NA	4.71E-10	8.77E-10
Beryllium	2.86E-12	8.55E-13	8.42E-13	NA	NA	NA	NA	NA	7.02E-12	1.16E-11
Noncarcinogens										
Acetaldehyde	8.54E-08	2.04E-14	5.00E-10	NA	NA	NA	NA	NA	2.00E-09	8.79E-08
Benzene	1.63E-16	6.10E-18	6.08E-15	NA	NA	NA	NA	NA	2.37E-16	6.48E-15
Ethylbenzene	4.03E-17	7.63E-18	6.69E-15	NA	NA	NA	NA	NA	3.28E-16	7.07E-15
Methyl Chloroform	2.59E-16	5.30E-14	1.25E-11	NA	NA	NA	NA	NA	6.18E-16	1.25E-11
Methylene Chloride	8.63E-15	7.03E-17	2.24E-13	NA	NA	NA	NA	NA	2.68E-15	2.35E-13
Tetrachloroethylene	2.02E-17	5.28E-18	2.40E-15	NA	NA	NA	NA	NA	5.97E-17	2.49E-15
Toluene	8.34E-16	8.48E-17	6.28E-14	NA	NA	NA	NA	NA	3.06E-15	6.68E-14
Vinyl Acetate	5.98E-15	2.11E-17	1.23E-13	NA	NA	NA	NA	NA	7.00E-16	1.30E-13
o-Xylene	8.82E-17	1.93E-17	1.47E-14	NA	NA	NA	NA	NA	7.28E-16	1.56E-14
p-Xylene	2.00E-15	4.12E-21	2.02E-17	NA	NA	NA	NA	NA	1.77E-14	1.97E-14
2-Methylnaphthalene	2.46E-17	1.19E-16	6.47E-15	NA	NA	NA	NA	NA	5.70E-16	7.19E-15

Table 54c (continued)

Chemical	Ingestion of:									Total
	Surface Water	Soil	Vegetation	Beef	Milk	Pork	Poultry	Egg	Fish	
Acenaphthene	1.23E-15	1.37E-16	2.35E-14	NA	NA	NA	NA	NA	4.35E-14	6.84E-14
Acenaphthylene	1.03E-16	1.01E-15	4.32E-14	NA	NA	NA	NA	NA	3.49E-16	4.46E-14
Anthracene	1.01E-16	3.52E-15	5.65E-14	NA	NA	NA	NA	NA	1.54E-14	7.55E-14
Benzo(g,h,i)perylene	3.40E-15	4.12E-14	4.27E-14	NA	NA	NA	NA	NA	NC	8.72E-14
Fluoranthene	1.84E-15	1.82E-14	1.41E-13	NA	NA	NA	NA	NA	1.69E-12	1.85E-12
Fluorene	1.81E-16	2.63E-18	6.70E-17	NA	NA	NA	NA	NA	1.27E-14	1.30E-14
Formaldehyde	7.34E-14	2.55E-17	2.56E-13	NA	NA	NA	NA	NA	1.44E-15	3.31E-13
Manganese	NC	2.90E-15	5.63E-12	NA	NA	NA	NA	NA	NC	5.63E-12
Naphthalene	4.51E-16	7.04E-16	1.89E-13	NA	NA	NA	NA	NA	5.67E-15	1.96E-13
Phenol	5.26E-11	1.02E-13	1.92E-10	NA	NA	NA	NA	NA	2.40E-11	2.69E-10
Pyrene	2.73E-15	7.65E-19	3.92E-16	NA	NA	NA	NA	NA	1.90E-12	1.90E-12
Arsenic	4.03E-10	6.06E-13	3.32E-12	NA	NA	NA	NA	NA	4.71E-10	8.77E-10
Beryllium	2.86E-12	8.55E-13	8.42E-13	NA	NA	NA	NA	NA	7.02E-12	1.16E-11
Cadmium	1.16E-11	9.91E-14	2.40E-12	NA	NA	NA	NA	NA	1.69E-10	1.83E-10
Chlorine	7.94E-05	1.66E-11	NC	NA	NA	NA	NA	NA	NC	7.94E-05
Chromium	1.98E-14	1.76E-11	2.06E-11	NA	NA	NA	NA	NA	2.20E-13	3.84E-11
Chromium VI	6.01E-10	4.07E-13	5.91E-12	NA	NA	NA	NA	NA	1.05E-10	7.13E-10
Nickel	1.69E-08	1.13E-10	6.46E-10	NA	NA	NA	NA	NA	7.73E-08	9.50E-08
Selenium	6.16E-10	3.37E-14	9.32E-13	NA	NA	NA	NA	NA	4.65E-09	5.27E-09

NC - Not Calculated NA - Not Applicable

Table 54d Estimates of Intake by the Subsistence Fisher Child for the ARFF Scenario

Chemical	Ingestion of: Surface Water	Soil	Vegetation	Beef	Milk	Pork	Poultry	Egg	Fish	Total
Carcinogens										
Acetaldehyde	1.91E-07	1.90E-13	7.52E-10	NA	NA	NA	NA	NA	1.30E-09	1.93E-07
Benzene	3.65E-16	5.69E-17	9.12E-15	NA	NA	NA	NA	NA	1.54E-16	9.70E-15
Methylene Chloride	1.93E-14	6.56E-16	3.36E-13	NA	NA	NA	NA	NA	1.74E-15	3.57E-13
Tetrachloroethylene	4.51E-17	4.93E-17	3.56E-15	NA	NA	NA	NA	NA	3.88E-17	3.69E-15
Benzo[a]anthracene	1.90E-14	5.42E-13	2.97E-13	NA	NA	NA	NA	NA	1.64E-12	2.50E-12
Benzo[b]flouranthene	9.52E-15	5.30E-13	1.67E-13	NA	NA	NA	NA	NA	1.61E-12	2.32E-12
Chrysene	3.06E-14	4.67E-13	2.45E-13	NA	NA	NA	NA	NA	3.13E-12	3.88E-12
Dibenz[a,h]anthracene	4.20E-16	1.90E-14	4.14E-14	NA	NA	NA	NA	NA	9.14E-14	1.52E-13
Formaldehyde	1.64E-13	2.38E-16	3.83E-13	NA	NA	NA	NA	NA	9.34E-16	5.48E-13
Indeno[1,2,3-cd]pyrene	4.29E-16	4.38E-14	3.87E-13	NA	NA	NA	NA	NA	9.54E-14	5.27E-13
2,3,7,8-TCDDioxin Toxicity Equivalents	1.06E-18	2.01E-16	3.45E-17	NA	NA	NA	NA	NA	7.08E-19	2.37E-16
Arsenic	8.99E-10	5.66E-12	4.65E-12	NA	NA	NA	NA	NA	3.06E-10	1.21E-09
Beryllium	6.39E-12	7.98E-12	1.17E-12	NA	NA	NA	NA	NA	4.56E-12	2.01E-11
Noncarcinogens										
Acetaldehyde	1.91E-07	1.90E-13	7.52E-10	NA	NA	NA	NA	NA	1.30E-09	1.93E-07
Benzene	3.65E-16	5.69E-17	9.12E-15	NA	NA	NA	NA	NA	1.54E-16	9.70E-15
Ethylbenzene	9.00E-17	7.12E-17	1.04E-14	NA	NA	NA	NA	NA	2.13E-16	1.07E-14
Methyl Chloroform	5.78E-16	4.95E-13	1.70E-11	NA	NA	NA	NA	NA	4.01E-16	1.75E-11
Methylene Chloride	1.93E-14	6.56E-16	3.36E-13	NA	NA	NA	NA	NA	1.74E-15	3.57E-13
Tetrachloroethylene	4.51E-17	4.93E-17	3.56E-15	NA	NA	NA	NA	NA	3.88E-17	3.69E-15
Toluene	1.86E-15	7.92E-16	9.57E-14	NA	NA	NA	NA	NA	1.98E-15	1.00E-13
Vinyl Acetate	1.34E-14	1.97E-16	1.83E-13	NA	NA	NA	NA	NA	4.54E-16	1.97E-13
o-Xylene	1.97E-16	1.80E-16	2.28E-14	NA	NA	NA	NA	NA	4.72E-16	2.36E-14
p-Xylene	4.48E-15	3.85E-20	2.86E-17	NA	NA	NA	NA	NA	1.15E-14	1.60E-14
2-Methylnaphthalene	5.49E-17	1.11E-15	9.16E-15	NA	NA	NA	NA	NA	3.70E-16	1.07E-14

Table 54d (continued)

Chemical	Ingestion of:									Total
	Surface Water	Soil	Vegetation	Beef	Milk	Pork	Poultry	Egg	Fish	
Acenaphthene	2.74E-15	1.28E-15	3.60E-14	NA	NA	NA	NA	NA	2.82E-14	6.82E-14
Acenaphthylene	2.29E-16	9.39E-15	6.15E-14	NA	NA	NA	NA	NA	2.26E-16	7.13E-14
Anthracene	2.26E-16	3.29E-14	7.78E-14	NA	NA	NA	NA	NA	9.98E-15	1.21E-13
Benzo(g,h,i)perylene	7.60E-15	3.84E-13	5.91E-14	NA	NA	NA	NA	NA	NC	4.51E-13
Fluoranthene	4.11E-15	1.69E-13	1.96E-13	NA	NA	NA	NA	NA	1.10E-12	1.47E-12
Fluorene	4.04E-16	2.45E-17	9.23E-17	NA	NA	NA	NA	NA	8.24E-15	8.76E-15
Formaldehyde	1.64E-13	2.38E-16	3.83E-13	NA	NA	NA	NA	NA	9.34E-16	5.48E-13
Manganese	NC	2.71E-14	7.88E-12	NA	NA	NA	NA	NA	NC	7.91E-12
Naphthalene	1.01E-15	6.57E-15	2.87E-13	NA	NA	NA	NA	NA	3.68E-15	2.98E-13
Phenol	1.17E-10	9.50E-13	2.84E-10	NA	NA	NA	NA	NA	1.56E-11	4.18E-10
Pyrene	6.09E-15	7.14E-18	5.48E-16	NA	NA	NA	NA	NA	1.23E-12	1.24E-12
Arsenic	8.99E-10	5.66E-12	4.65E-12	NA	NA	NA	NA	NA	3.06E-10	1.21E-09
Beryllium	6.39E-12	7.98E-12	1.17E-12	NA	NA	NA	NA	NA	4.56E-12	2.01E-11
Cadmium	2.59E-11	9.25E-13	3.33E-12	NA	NA	NA	NA	NA	1.10E-10	1.40E-10
Chlorine	1.77E-04	1.55E-10	NC	NA	NA	NA	NA	NA	NC	1.77E-04
Chromium	4.41E-14	1.64E-10	2.87E-11	NA	NA	NA	NA	NA	1.43E-13	1.93E-10
Chromium VI	1.34E-09	3.80E-12	8.28E-12	NA	NA	NA	NA	NA	6.84E-11	1.42E-09
Nickel	3.79E-08	1.05E-09	9.04E-10	NA	NA	NA	NA	NA	5.02E-08	9.00E-08
Selenium	1.38E-09	3.15E-13	1.30E-12	NA	NA	NA	NA	NA	3.02E-09	4.40E-09

NC - Not Calculated NA - Not Applicable

Table 54e Estimates of Intake by the Adult Resident for the ARFF Scenario

Chemical	Ingestion of: Surface Water	Soil	Vegetation	Beef	Milk	Pork	Poultry	Egg	Fish	Total
Carcinogens										
Acetaldehyde	8.54E-08	2.04E-14	5.00E-10	NA	NA	NA	NA	NA	NA	8.59E-08
Benzene	1.63E-16	6.10E-18	6.08E-15	NA	NA	NA	NA	NA	NA	6.25E-15
Methylene Chloride	8.63E-15	7.03E-17	2.24E-13	NA	NA	NA	NA	NA	NA	2.33E-13
Tetrachloroethylene	2.02E-17	5.28E-18	2.40E-15	NA	NA	NA	NA	NA	NA	2.43E-15
Benzo[a]anthracene	8.49E-15	5.81E-14	2.13E-13	NA	NA	NA	NA	NA	NA	2.79E-13
Benzo[b]flouranthene	4.26E-15	5.68E-14	1.18E-13	NA	NA	NA	NA	NA	NA	1.79E-13
Chrysene	1.37E-14	5.00E-14	1.75E-13	NA	NA	NA	NA	NA	NA	2.39E-13
Dibenz[a,h]anthracene	1.88E-16	2.03E-15	2.95E-14	NA	NA	NA	NA	NA	NA	3.18E-14
Formaldehyde	7.34E-14	2.55E-17	2.56E-13	NA	NA	NA	NA	NA	NA	3.30E-13
Indeno[1,2,3-cd]pyrene	1.92E-16	4.69E-15	2.77E-13	NA	NA	NA	NA	NA	NA	2.82E-13
2,3,7,8-TCDDioxin Toxicity Equivalents	4.76E-19	2.15E-17	2.44E-17	NA	NA	NA	NA	NA	NA	4.63E-17
Arsenic	4.03E-10	6.06E-13	3.32E-12	NA	NA	NA	NA	NA	NA	4.06E-10
Beryllium	2.86E-12	8.55E-13	8.42E-13	NA	NA	NA	NA	NA	NA	4.56E-12
Noncarcinogens										
Acetaldehyde	8.54E-08	2.04E-14	5.00E-10	NA	NA	NA	NA	NA	NA	8.59E-08
Benzene	1.63E-16	6.10E-18	6.08E-15	NA	NA	NA	NA	NA	NA	6.25E-15
Ethylbenzene	4.03E-17	7.63E-18	6.69E-15	NA	NA	NA	NA	NA	NA	6.74E-15
Methyl Chloroform	2.59E-16	5.30E-14	1.25E-11	NA	NA	NA	NA	NA	NA	1.25E-11
Methylene Chloride	8.63E-15	7.03E-17	2.24E-13	NA	NA	NA	NA	NA	NA	2.33E-13
Tetrachloroethylene	2.02E-17	5.28E-18	2.40E-15	NA	NA	NA	NA	NA	NA	2.43E-15
Toluene	8.34E-16	8.48E-17	6.28E-14	NA	NA	NA	NA	NA	NA	6.37E-14
Vinyl Acetate	5.98E-15	2.11E-17	1.23E-13	NA	NA	NA	NA	NA	NA	1.29E-13
o-Xylene	8.82E-17	1.93E-17	1.47E-14	NA	NA	NA	NA	NA	NA	1.48E-14
p-Xylene	2.00E-15	4.12E-21	2.02E-17	NA	NA	NA	NA	NA	NA	2.02E-15
2-Methylnaphthalene	2.46E-17	1.19E-16	6.47E-15	NA	NA	NA	NA	NA	NA	6.62E-15

Table 54e (continued)

Chemical	Ingestion of: Surface Water	Soil	Vegetation	Beef	Milk	Pork	Poultry	Egg	Fish	Total
Acenaphthene	1.23E-15	1.37E-16	2.35E-14	NA	NA	NA	NA	NA	NA	2.49E-14
Acenaphthylene	1.03E-16	1.01E-15	4.32E-14	NA	NA	NA	NA	NA	NA	4.43E-14
Anthracene	1.01E-16	3.52E-15	5.65E-14	NA	NA	NA	NA	NA	NA	6.01E-14
Benzo(g,h,i)perylene	3.40E-15	4.12E-14	4.27E-14	NA	NA	NA	NA	NA	NA	8.72E-14
Fluoranthene	1.84E-15	1.82E-14	1.41E-13	NA	NA	NA	NA	NA	NA	1.61E-13
Fluorene	1.81E-16	2.63E-18	6.70E-17	NA	NA	NA	NA	NA	NA	2.51E-16
Formaldehyde	7.34E-14	2.55E-17	2.56E-13	NA	NA	NA	NA	NA	NA	3.30E-13
Manganese	NC	2.90E-15	5.63E-12	NA	NA	NA	NA	NA	NA	5.63E-12
Naphthalene	4.51E-16	7.04E-16	1.89E-13	NA	NA	NA	NA	NA	NA	1.90E-13
Phenol	5.26E-11	1.02E-13	1.92E-10	NA	NA	NA	NA	NA	NA	2.45E-10
Pyrene	2.73E-15	7.65E-19	3.92E-16	NA	NA	NA	NA	NA	NA	3.12E-15
Arsenic	4.03E-10	6.06E-13	3.32E-12	NA	NA	NA	NA	NA	NA	4.06E-10
Beryllium	2.86E-12	8.55E-13	8.42E-13	NA	NA	NA	NA	NA	NA	4.56E-12
Cadmium	1.16E-11	9.91E-14	2.40E-12	NA	NA	NA	NA	NA	NA	1.41E-11
Chlorine	7.94E-05	1.66E-11	NC	NA	NA	NA	NA	NA	NA	7.94E-05
Chromium	1.98E-14	1.76E-11	2.06E-11	NA	NA	NA	NA	NA	NA	3.82E-11
Chromium VI	6.01E-10	4.07E-13	5.91E-12	NA	NA	NA	NA	NA	NA	6.07E-10
Nickel	1.69E-08	1.13E-10	6.46E-10	NA	NA	NA	NA	NA	NA	1.77E-08
Selenium	6.16E-10	3.37E-14	9.32E-13	NA	NA	NA	NA	NA	NA	6.17E-10

NC - Not Calculated NA - Not Applicable

Table 54f Estimates of Intake by the Child Resident for the ARFF Scenario

Chemical	Ingestion of: Surface Water	Soil	Vegetation	Beef	Milk	Pork	Poultry	Egg	Fish	Total
Carcinogens										
Acetaldehyde	1.91E-07	1.90E-13	7.52E-10	NA	NA	NA	NA	NA	NA	1.91E-07
Benzene	3.65E-16	5.69E-17	9.12E-15	NA	NA	NA	NA	NA	NA	9.55E-15
Methylene Chloride	1.93E-14	6.56E-16	3.36E-13	NA	NA	NA	NA	NA	NA	3.56E-13
Tetrachloroethylene	4.51E-17	4.93E-17	3.56E-15	NA	NA	NA	NA	NA	NA	3.65E-15
Benzo[a]anthracene	1.90E-14	5.42E-13	2.97E-13	NA	NA	NA	NA	NA	NA	8.58E-13
Benzo[b]flouranthene	9.52E-15	5.30E-13	1.67E-13	NA	NA	NA	NA	NA	NA	7.06E-13
Chrysene	3.06E-14	4.67E-13	2.45E-13	NA	NA	NA	NA	NA	NA	7.42E-13
Dibenz[a,h]anthracene	4.20E-16	1.90E-14	4.14E-14	NA	NA	NA	NA	NA	NA	6.08E-14
Formaldehyde	1.64E-13	2.38E-16	3.83E-13	NA	NA	NA	NA	NA	NA	5.47E-13
Indeno[1,2,3-cd]pyrene	4.29E-16	4.38E-14	3.87E-13	NA	NA	NA	NA	NA	NA	4.32E-13
2,3,7,8-TCDDioxin Toxicity Equivalents	1.06E-18	2.01E-16	3.45E-17	NA	NA	NA	NA	NA	NA	2.36E-16
Arsenic	8.99E-10	5.66E-12	4.65E-12	NA	NA	NA	NA	NA	NA	9.09E-10
Beryllium	6.39E-12	7.98E-12	1.17E-12	NA	NA	NA	NA	NA	NA	1.55E-11
Noncarcinogens										
Acetaldehyde	1.91E-07	1.90E-13	7.52E-10	NA	NA	NA	NA	NA	NA	1.91E-07
Benzene	3.65E-16	5.69E-17	9.12E-15	NA	NA	NA	NA	NA	NA	9.55E-15
Ethylbenzene	9.00E-17	7.12E-17	1.04E-14	NA	NA	NA	NA	NA	NA	1.05E-14
Methyl Chloroform	5.78E-16	4.95E-13	1.70E-11	NA	NA	NA	NA	NA	NA	1.75E-11
Methylene Chloride	1.93E-14	6.56E-16	3.36E-13	NA	NA	NA	NA	NA	NA	3.56E-13
Tetrachloroethylene	4.51E-17	4.93E-17	3.56E-15	NA	NA	NA	NA	NA	NA	3.65E-15
Toluene	1.86E-15	7.92E-16	9.57E-14	NA	NA	NA	NA	NA	NA	9.84E-14
Vinyl Acetate	1.34E-14	1.97E-16	1.83E-13	NA	NA	NA	NA	NA	NA	1.97E-13
o-Xylene	1.97E-16	1.80E-16	2.28E-14	NA	NA	NA	NA	NA	NA	2.32E-14
p-Xylene	4.48E-15	3.85E-20	2.86E-17	NA	NA	NA	NA	NA	NA	4.51E-15
2-Methylnaphthalene	5.49E-17	1.11E-15	9.16E-15	NA	NA	NA	NA	NA	NA	1.03E-14

Table 54f (continued)

Chemical	Ingestion of: Surface Water	Soil	Vegetation	Beef	Milk	Pork	Poultry	Egg	Fish	Total
Acenaphthene	2.74E-15	1.28E-15	3.60E-14	NA	NA	NA	NA	NA	NA	4.00E-14
Acenaphthylene	2.29E-16	9.39E-15	6.15E-14	NA	NA	NA	NA	NA	NA	7.11E-14
Anthracene	2.26E-16	3.29E-14	7.78E-14	NA	NA	NA	NA	NA	NA	1.11E-13
Benzo(g,h,i)perylene	7.60E-15	3.84E-13	5.91E-14	NA	NA	NA	NA	NA	NA	4.51E-13
Fluoranthene	4.11E-15	1.69E-13	1.96E-13	NA	NA	NA	NA	NA	NA	3.70E-13
Fluorene	4.04E-16	2.45E-17	9.23E-17	NA	NA	NA	NA	NA	NA	5.21E-16
Formaldehyde	1.64E-13	2.38E-16	3.83E-13	NA	NA	NA	NA	NA	NA	5.47E-13
Manganese	NC	2.71E-14	7.88E-12	NA	NA	NA	NA	NA	NA	7.91E-12
Naphthalene	1.01E-15	6.57E-15	2.87E-13	NA	NA	NA	NA	NA	NA	2.95E-13
Phenol	1.17E-10	9.50E-13	2.84E-10	NA	NA	NA	NA	NA	NA	4.03E-10
Pyrene	6.09E-15	7.14E-18	5.48E-16	NA	NA	NA	NA	NA	NA	6.65E-15
Arsenic	8.99E-10	5.66E-12	4.65E-12	NA	NA	NA	NA	NA	NA	9.09E-10
Beryllium	6.39E-12	7.98E-12	1.17E-12	NA	NA	NA	NA	NA	NA	1.55E-11
Cadmium	2.59E-11	9.25E-13	3.33E-12	NA	NA	NA	NA	NA	NA	3.01E-11
Chlorine	1.77E-04	1.55E-10	NC	NA	NA	NA	NA	NA	NA	1.77E-04
Chromium	4.41E-14	1.64E-10	2.87E-11	NA	NA	NA	NA	NA	NA	1.93E-10
Chromium VI	1.34E-09	3.80E-12	8.28E-12	NA	NA	NA	NA	NA	NA	1.35E-09
Nickel	3.79E-08	1.05E-09	9.04E-10	NA	NA	NA	NA	NA	NA	3.98E-08
Selenium	1.38E-09	3.15E-13	1.30E-12	NA	NA	NA	NA	NA	NA	1.38E-09

NC - Not Calculated NA - Not Applicable

Table 55a Estimates of Intake by the Subsistence Farmer for the Propane Scenario

	Ingestion of:									
Chemical	Surface Water	Soil	Vegetation	Beef	Milk	Pork	Poultry	Egg	Fish	Total
Carcinogens										
Benzene	2.34E-15	3.51E-17	1.40E-13	2.60E-18	1.04E-17	5.94E-19	1.92E-20	7.83E-18	NA	1.42E-13
Formaldehyde	9.73E-13	1.42E-16	5.70E-12	1.82E-18	7.32E-18	4.08E-19	1.31E-20	5.32E-18	NA	6.67E-12
Arsenic	1.86E-12	1.44E-15	7.39E-14	5.66E-14	1.88E-14	NC	NC	NC	NA	2.01E-12
Noncarcinogens										
Benzene	2.34E-15	3.51E-17	1.40E-13	2.60E-18	1.04E-17	5.94E-19	1.92E-20	7.83E-18	NA	1.42E-13
Toluene	1.52E-14	6.22E-16	1.84E-12	7.93E-17	3.12E-16	1.82E-17	5.97E-19	2.43E-16	NA	1.86E-12
2-Methylnaphthalene	5.41E-16	1.04E-15	2.28E-13	1.29E-16	4.85E-15	1.01E-16	1.43E-15	1.45E-15	NA	2.38E-13
Fluoranthene	4.47E-15	2.04E-14	6.33E-13	6.19E-14	1.90E-13	1.66E-14	6.49E-16	2.64E-13	NA	1.19E-12
Fluorene	3.75E-16	2.16E-18	2.22E-16	1.95E-17	6.91E-17	1.09E-18	1.40E-20	5.72E-18	NA	6.95E-16
Formaldehyde	9.73E-13	1.42E-16	5.70E-12	1.82E-18	7.32E-18	4.08E-19	1.31E-20	5.32E-18	NA	6.67E-12
Naphthalene	1.28E-14	7.97E-15	8.55E-12	2.13E-15	8.16E-15	5.12E-16	1.73E-17	7.05E-15	NA	8.59E-12
Pyrene	5.37E-15	5.94E-19	1.56E-15	1.39E-14	4.94E-14	5.46E-16	1.61E-20	6.58E-18	NA	7.08E-14
Arsenic	1.86E-12	1.44E-15	7.39E-14	5.66E-14	1.88E-14	NC	NC	NC	NA	2.01E-12
Nickel	4.84E-11	1.67E-13	5.51E-12	1.15E-11	2.11E-11	NC	NC	NC	NA	8.66E-11

NC - Not Calculated NA - Not Applicable

Table 55b Estimates of Intake by the Subsistence Farmer Child for the Propane Scenario

Chemical	Ingestion of: Surface Water	Soil	Vegetation	Beef	Milk	Pork	Poultry	Egg	Fish	Total
Carcinogens										
Benzene	5.22E-15	4.36E-16	2.80E-13	1.55E-18	3.06E-17	5.94E-19	1.79E-20	7.37E-18	NA	2.86E-13
Formaldehyde	2.17E-12	1.77E-15	1.14E-11	1.08E-18	2.15E-17	4.09E-19	1.21E-20	5.02E-18	NA	1.35E-11
Arsenic	5.15E-12	1.76E-14	1.06E-13	2.56E-14	4.19E-14	NC	NC	NC	NA	5.34E-12
Noncarcinogens										
Benzene	5.22E-15	4.36E-16	2.80E-13	1.55E-18	3.06E-17	5.94E-19	1.79E-20	7.37E-18	NA	2.86E-13
Toluene	3.41E-14	7.74E-15	3.74E-12	4.72E-17	9.16E-16	1.82E-17	5.55E-19	2.29E-16	NA	3.78E-12
2-Methylnaphthalene	1.21E-15	1.30E-14	4.30E-13	7.72E-17	1.42E-14	1.02E-16	1.33E-15	1.37E-15	NA	4.62E-13
Fluoranthene	1.10E-14	2.43E-13	1.13E-12	3.40E-14	5.13E-13	1.59E-14	5.78E-16	2.38E-13	NA	2.18E-12
Fluorene	8.37E-16	2.68E-17	4.03E-16	8.93E-18	1.56E-16	9.17E-19	1.30E-20	5.38E-18	NA	1.44E-15
Formaldehyde	2.17E-12	1.77E-15	1.14E-11	1.08E-18	2.15E-17	4.09E-19	1.21E-20	5.02E-18	NA	1.35E-11
Naphthalene	2.87E-14	9.92E-14	1.73E-11	1.27E-15	2.40E-14	5.12E-16	1.61E-17	6.64E-15	NA	1.75E-11
Pyrene	1.20E-14	7.39E-18	2.19E-15	6.23E-15	1.09E-13	4.10E-16	1.50E-20	6.19E-18	NA	1.30E-13
Arsenic	5.15E-12	1.76E-14	1.06E-13	2.56E-14	4.19E-14	NC	NC	NC	NA	5.34E-12
Nickel	1.32E-10	2.00E-12	8.13E-12	5.22E-12	4.71E-11	NC	NC	NC	NA	1.95E-10

NC - Not Calculated NA - Not Applicable

Table 55c Estimates of Intake by the Subsistence Fisher for the Propane Scenario

Chemical	Ingestion of:									Total
	Surface Water	Soil	Vegetation	Beef	Milk	Pork	Poultry	Egg	Fish	
Carcinogens										
Benzene	2.34E-15	4.67E-17	4.66E-14	NA	NA	NA	NA	NA	3.39E-15	5.24E-14
Formaldehyde	9.74E-13	1.89E-16	1.90E-12	NA	NA	NA	NA	NA	1.91E-14	2.89E-12
Arsenic	2.31E-12	1.89E-15	1.90E-14	NA	NA	NA	NA	NA	2.70E-12	5.03E-12
Noncarcinogens										
Benzene	2.34E-15	4.67E-17	4.66E-14	NA	NA	NA	NA	NA	3.39E-15	5.24E-14
Toluene	1.52E-14	8.29E-16	6.13E-13	NA	NA	NA	NA	NA	5.59E-14	6.85E-13
2-Methylnaphthalene	5.44E-16	1.39E-15	7.60E-14	NA	NA	NA	NA	NA	1.26E-14	9.05E-14
Fluoranthene	4.91E-15	2.61E-14	2.02E-13	NA	NA	NA	NA	NA	4.51E-12	4.74E-12
Fluorene	3.75E-16	2.88E-18	7.30E-17	NA	NA	NA	NA	NA	2.63E-14	2.68E-14
Formaldehyde	9.74E-13	1.89E-16	1.90E-12	NA	NA	NA	NA	NA	1.91E-14	2.89E-12
Naphthalene	1.28E-14	1.06E-14	2.85E-12	NA	NA	NA	NA	NA	1.61E-13	3.03E-12
Pyrene	5.37E-15	7.92E-19	3.91E-16	NA	NA	NA	NA	NA	3.74E-12	3.74E-12
Arsenic	2.31E-12	1.89E-15	1.90E-14	NA	NA	NA	NA	NA	2.70E-12	5.03E-12
Nickel	5.93E-11	2.14E-13	1.45E-12	NA	NA	NA	NA	NA	2.71E-10	3.32E-10

NA - Not Applicable

Table 55d Estimates of Intake by the Subsistence Fisher Child for the Propane Scenario

Chemical	Ingestion of: Surface Water	Soil	Vegetation	Beef	Milk	Pork	Poultry	Egg	Fish	Total
Carcinogens										
Benzene	5.22E-15	4.36E-16	7.00E-14	NA	NA	NA	NA	NA	2.20E-15	7.78E-14
Formaldehyde	2.17E-12	1.77E-15	2.84E-12	NA	NA	NA	NA	NA	1.24E-14	5.03E-12
Arsenic	5.15E-12	1.76E-14	2.66E-14	NA	NA	NA	NA	NA	1.75E-12	6.95E-12
Noncarcinogens										
Benzene	5.22E-15	4.36E-16	7.00E-14	NA	NA	NA	NA	NA	2.20E-15	7.78E-14
Toluene	3.41E-14	7.74E-15	9.35E-13	NA	NA	NA	NA	NA	3.63E-14	1.01E-12
2-Methylnaphthalene	1.21E-15	1.30E-14	1.08E-13	NA	NA	NA	NA	NA	8.17E-15	1.30E-13
Fluoranthene	1.10E-14	2.43E-13	2.82E-13	NA	NA	NA	NA	NA	2.93E-12	3.46E-12
Fluorene	8.37E-16	2.68E-17	1.01E-16	NA	NA	NA	NA	NA	1.71E-14	1.80E-14
Formaldehyde	2.17E-12	1.77E-15	2.84E-12	NA	NA	NA	NA	NA	1.24E-14	5.03E-12
Naphthalene	2.87E-14	9.92E-14	4.33E-12	NA	NA	NA	NA	NA	1.05E-13	4.57E-12
Pyrene	1.20E-14	7.39E-18	5.48E-16	NA	NA	NA	NA	NA	2.42E-12	2.44E-12
Arsenic	5.15E-12	1.76E-14	2.66E-14	NA	NA	NA	NA	NA	1.75E-12	6.95E-12
Nickel	1.32E-10	2.00E-12	2.03E-12	NA	NA	NA	NA	NA	1.76E-10	3.12E-10

NA - Not Applicable

Table 55e Estimates of Intake by the Adult Resident for the Propane Scenario

	Ingestion of:									
Chemical	Surface Water	Soil	Vegetation	Beef	Milk	Pork	Poultry	Egg	Fish	Total
Carcinogens										
Benzene	2.34E-15	4.67E-17	4.66E-14	NA	NA	NA	NA	NA	NA	4.90E-14
Formaldehyde	9.74E-13	1.89E-16	1.90E-12	NA	NA	NA	NA	NA	NA	2.87E-12
Arsenic	2.31E-12	1.89E-15	1.90E-14	NA	NA	NA	NA	NA	NA	2.33E-12
Noncarcinogens										
Benzene	2.34E-15	4.67E-17	4.66E-14	NA	NA	NA	NA	NA	NA	4.90E-14
Toluene	1.52E-14	8.29E-16	6.13E-13	NA	NA	NA	NA	NA	NA	6.30E-13
2-Methylnaphthalene	5.44E-16	1.39E-15	7.60E-14	NA	NA	NA	NA	NA	NA	7.79E-14
Fluoranthene	4.91E-15	2.61E-14	2.02E-13	NA	NA	NA	NA	NA	NA	2.33E-13
Fluorene	3.75E-16	2.88E-18	7.30E-17	NA	NA	NA	NA	NA	NA	4.51E-16
Formaldehyde	9.74E-13	1.89E-16	1.90E-12	NA	NA	NA	NA	NA	NA	2.87E-12
Naphthalene	1.28E-14	1.06E-14	2.85E-12	NA	NA	NA	NA	NA	NA	2.87E-12
Pyrene	5.37E-15	7.92E-19	3.91E-16	NA	NA	NA	NA	NA	NA	5.76E-15
Arsenic	2.31E-12	1.89E-15	1.90E-14	NA	NA	NA	NA	NA	NA	2.33E-12
Nickel	5.93E-11	2.14E-13	1.45E-12	NA	NA	NA	NA	NA	NA	6.10E-11

NA - Not Applicable

Table 55f Estimates of Intake by the Child Resident for the Propane Scenario

Chemical	Ingestion of:									Total
	Surface Water	Soil	Vegetation	Beef	Milk	Pork	Poultry	Egg	Fish	
Carcinogens										
Benzene	5.22E-15	4.36E-16	7.00E-14	NA	NA	NA	NA	NA	NA	7.56E-14
Formaldehyde	2.17E-12	1.77E-15	2.84E-12	NA	NA	NA	NA	NA	NA	5.02E-12
Arsenic	5.15E-12	1.76E-14	2.66E-14	NA	NA	NA	NA	NA	NA	5.20E-12
Noncarcinogens										
Benzene	5.22E-15	4.36E-16	7.00E-14	NA	NA	NA	NA	NA	NA	7.56E-14
Toluene	3.41E-14	7.74E-15	9.35E-13	NA	NA	NA	NA	NA	NA	9.77E-13
2-Methylnaphthalene	1.21E-15	1.30E-14	1.08E-13	NA	NA	NA	NA	NA	NA	1.22E-13
Fluoranthene	1.10E-14	2.43E-13	2.82E-13	NA	NA	NA	NA	NA	NA	5.36E-13
Fluorene	8.37E-16	2.68E-17	1.01E-16	NA	NA	NA	NA	NA	NA	9.65E-16
Formaldehyde	2.17E-12	1.77E-15	2.84E-12	NA	NA	NA	NA	NA	NA	5.02E-12
Naphthalene	2.87E-14	9.92E-14	4.33E-12	NA	NA	NA	NA	NA	NA	4.46E-12
Pyrene	1.20E-14	7.39E-18	5.48E-16	NA	NA	NA	NA	NA	NA	1.25E-14
Arsenic	5.15E-12	1.76E-14	2.66E-14	NA	NA	NA	NA	NA	NA	5.20E-12
Nickel	1.32E-10	2.00E-12	2.03E-12	NA	NA	NA	NA	NA	NA	1.37E-10

NA - Not Applicable

Table 56a Estimates of Intake by the Subsistence Farmer for the Drill Tower Scenario

Chemical	Ingestion of: Surface Water	Soil	Vegetation	Beef	Milk	Pork	Poultry	Egg	Fish	Total
Carcinogens										
Benzene	1.32E-11	7.32E-13	2.92E-09	5.44E-14	2.17E-13	1.24E-14	4.01E-16	1.64E-13	NA	2.93E-09
Benzo(a)pyrene	2.84E-11	3.08E-10	5.01E-09	NC	NC	NC	NC	NC	NA	5.35E-09
Benzo[a]anthracene	3.30E-10	4.14E-09	6.18E-08	NC	NC	NC	NC	NC	NA	6.63E-08
Benzo[b]fluoranthene	6.46E-11	1.57E-09	1.39E-08	NC	NC	NC	NC	NC	NA	1.55E-08
Benzo[k]fluoranthene	3.97E-11	6.01E-10	6.94E-09	NC	NC	NC	NC	NC	NA	7.58E-09
Chrysene	6.83E-10	4.80E-09	6.94E-08	NC	NC	NC	NC	NC	NA	7.49E-08
Dibenz[a,h]anthracene	9.23E-12	4.12E-10	8.97E-09	NC	NC	NC	NC	NC	NA	9.39E-09
Indeno[1,2,3-cd]pyrene	6.33E-12	6.33E-10	2.88E-08	NC	NC	NC	NC	NC	NA	2.94E-08
Arsenic	3.82E-10	2.23E-12	1.67E-10	1.30E-10	4.32E-11	NC	NC	NC	NA	7.24E-10
Chromium VI	3.53E-09	9.23E-12	1.03E-09	2.25E-09	6.81E-09	NC	NC	NC	NA	1.36E-08
Noncarcinogens										
Benzaldehyde	1.58E-10	4.28E-12	3.39E-08	1.66E-13	6.63E-13	3.74E-14	1.20E-15	4.89E-13	NA	3.41E-08
Benzene	1.32E-11	7.32E-13	2.92E-09	5.44E-14	2.17E-13	1.24E-14	4.01E-16	1.64E-13	NA	2.93E-09
Methyl Ethyl Ketone	1.05E-10	1.87E-13	8.27E-09	2.25E-15	9.02E-15	5.05E-16	1.62E-17	6.56E-15	NA	8.38E-09
Styrene	4.99E-12	6.19E-12	6.16E-09	1.03E-12	4.02E-12	2.41E-13	7.95E-15	3.24E-12	NA	6.18E-09
Toluene	4.30E-12	6.52E-13	1.93E-09	8.32E-14	3.27E-13	1.91E-14	6.26E-16	2.55E-13	NA	1.94E-09
o-Xylene	1.78E-12	5.77E-13	1.76E-09	1.20E-13	4.66E-13	2.81E-14	9.39E-16	3.81E-13	NA	1.77E-09
2-Methylnaphthalene	4.44E-13	3.18E-12	6.95E-10	3.95E-13	1.48E-11	3.09E-13	4.35E-12	4.43E-12	NA	7.23E-10
Acenaphthene	5.25E-12	8.64E-13	6.07E-10	NC	NC	NC	NC	NC	NA	6.13E-10
Acenaphthylene	4.66E-11	6.91E-10	1.19E-07	NC	NC	NC	NC	NC	NA	1.20E-07
Anthracene	5.21E-12	2.82E-10	1.81E-08	NC	NC	NC	NC	NC	NA	1.84E-08
Benzo(g,h,i)perylene	1.05E-10	3.49E-09	1.58E-08	NC	NC	NC	NC	NC	NA	1.94E-08
Fluoranthene	2.05E-10	3.48E-09	1.08E-07	NC	NC	NC	NC	NC	NA	1.12E-07
Fluorene	7.52E-12	1.61E-13	1.72E-11	1.51E-12	5.36E-12	8.24E-14	1.05E-15	4.26E-13	NA	3.22E-11
Furans	1.40E-12	2.95E-14	1.30E-10	1.02E-15	4.11E-15	2.29E-16	2.96E-15	3.01E-15	NA	1.32E-10

Table 56a (continued)

Chemical	Ingestion of: Surface Water	Soil	Vegetation	Beef	Milk	Pork	Poultry	Egg	Fish	Total
Manganese	NC	2.02E-13	3.14E-09	NC	NC	NC	NC	NC	NA	3.14E-09
Naphthalene	9.09E-11	2.11E-10	2.26E-07	5.63E-11	2.16E-10	1.35E-11	4.58E-13	1.87E-10	NA	2.27E-07
Phenol	2.55E-08	8.52E-11	6.42E-07	3.30E-12	1.32E-11	7.45E-13	2.39E-14	9.73E-12	NA	6.68E-07
Pyrene	1.29E-10	5.33E-14	2.06E-10	1.29E-09	4.58E-09	4.96E-11	1.45E-15	5.90E-13	NA	6.26E-09
n-Hexane	6.58E-15	1.64E-15	1.42E-12	1.45E-15	5.25E-15	1.36E-16	1.29E-15	1.31E-15	NA	1.44E-12
Antimony	1.16E-08	1.53E-10	1.04E-08	3.16E-09	3.53E-09	NC	NC	NC	NA	2.88E-08
Arsenic	3.82E-10	2.23E-12	1.67E-10	1.30E-10	4.32E-11	NC	NC	NC	NA	7.24E-10
Barium	1.29E-06	1.43E-08	1.02E-06	4.77E-08	1.24E-06	NC	NC	NC	NA	3.62E-06
Cadmium	1.19E-08	3.98E-10	4.38E-08	7.15E-10	4.41E-10	7.57E-11	1.71E-09	4.09E-11	NA	5.90E-08
Chlorine	2.21E-03	9.59E-10	NC	3.06E-08	3.39E-08	NC	NC	NC	NA	2.21E-03
Chromium	1.78E-13	6.56E-10	3.24E-09	3.92E-09	9.97E-09	NC	NC	NC	NA	1.78E-08
Chromium VI	3.53E-09	9.23E-12	1.03E-09	2.25E-09	6.81E-09	NC	NC	NC	NA	1.36E-08
Nickel	8.93E-10	2.32E-11	8.86E-10	1.89E-09	3.47E-09	NC	NC	NC	NA	7.16E-09
Selenium	5.93E-09	1.25E-12	5.14E-10	4.58E-10	1.32E-08	7.98E-10	1.52E-11	1.54E-11	NA	2.09E-08
Silver	4.90E-08	2.66E-11	9.01E-09	8.25E-09	6.16E-07	NC	NC	NC	NA	6.82E-07
Zinc	1.46E-08	3.47E-10	2.82E-08	5.06E-10	2.06E-09	3.74E-11	9.32E-11	9.47E-11	NA	4.59E-08

NC - Not Calculated NA - Not Applicable

Table 56b Estimates of Intake by the Subsistence Farmer Child for the Drill Tower Scenario

	Ingestion of:									
Chemical	Surface Water	Soil	Vegetation	Beef	Milk	Pork	Poultry	Egg	Fish	Total
Carcinogens										
Benzene	2.94E-11	9.11E-12	5.85E-09	3.24E-14	6.39E-13	1.24E-14	3.73E-16	1.54E-13	NA	5.89E-09
Benzo(a)pyrene	7.04E-11	3.57E-09	7.84E-09	NC	NC	NC	NC	NC	NA	1.15E-08
Benzo[a]anthracene	8.17E-10	4.73E-08	1.05E-07	NC	NC	NC	NC	NC	NA	1.53E-07
Benzo[b]fluoranthene	1.59E-10	1.80E-08	2.35E-08	NC	NC	NC	NC	NC	NA	4.17E-08
Benzo[k]fluoranthene	9.32E-11	5.98E-09	1.02E-08	NC	NC	NC	NC	NC	NA	1.63E-08
Chrysene	1.69E-09	5.29E-08	1.13E-07	NC	NC	NC	NC	NC	NA	1.68E-07
Dibenz[a,h]anthracene	2.39E-11	4.53E-09	1.32E-08	NC	NC	NC	NC	NC	NA	1.78E-08
Indeno[1,2,3-cd]pyrene	1.67E-11	7.15E-09	4.11E-08	NC	NC	NC	NC	NC	NA	4.83E-08
Arsenic	1.06E-09	2.72E-11	2.38E-10	5.85E-11	9.60E-11	NC	NC	NC	NA	1.48E-09
Chromium VI	9.81E-09	1.13E-10	1.46E-09	1.01E-09	1.50E-08	NC	NC	NC	NA	2.74E-08
Noncarcinogens										
Benzaldehyde	3.58E-10	5.33E-11	6.73E-08	9.88E-14	1.95E-12	3.75E-14	1.12E-15	4.61E-13	NA	6.77E-08
Benzene	2.94E-11	9.11E-12	5.85E-09	3.24E-14	6.39E-13	1.24E-14	3.73E-16	1.54E-13	NA	5.89E-09
Methyl Ethyl Ketone	2.35E-10	2.32E-12	1.65E-08	1.34E-15	2.65E-14	5.06E-16	1.50E-17	6.18E-15	NA	1.67E-08
Styrene	1.12E-11	7.70E-11	1.21E-08	6.12E-13	1.18E-11	2.41E-13	7.38E-15	3.05E-12	NA	1.22E-08
Toluene	9.61E-12	8.11E-12	3.93E-09	4.95E-14	9.61E-13	1.91E-14	5.82E-16	2.40E-13	NA	3.94E-09
o-Xylene	3.97E-12	7.18E-12	3.63E-09	7.15E-14	1.37E-12	2.81E-14	8.72E-16	3.59E-13	NA	3.65E-09
2-Methylnaphthalene	9.96E-13	3.96E-11	1.31E-09	2.35E-13	4.34E-11	3.10E-13	4.04E-12	4.17E-12	NA	1.40E-09
Acenaphthene	1.17E-11	1.08E-11	1.22E-09	NC	NC	NC	NC	NC	NA	1.24E-09
Acenaphthylene	1.06E-10	8.58E-09	2.25E-07	NC	NC	NC	NC	NC	NA	2.34E-07
Anthracene	1.21E-11	3.48E-09	3.30E-08	NC	NC	NC	NC	NC	NA	3.65E-08
Benzo(g,h,i)perylene	1.93E-10	2.64E-08	1.88E-08	NC	NC	NC	NC	NC	NA	4.54E-08
Fluoranthene	5.04E-10	4.16E-08	1.93E-07	NC	NC	NC	NC	NC	NA	2.35E-07
Fluorene	1.68E-11	2.00E-12	3.09E-11	6.92E-13	1.21E-11	6.91E-14	9.73E-16	4.02E-13	NA	6.29E-11
Furans	3.12E-12	3.67E-13	2.42E-10	6.10E-16	1.21E-14	2.29E-16	2.75E-15	2.83E-15	NA	2.45E-10

Table 56b (continued)

Chemical	Ingestion of: Surface Water	Soil	Vegetation	Beef	Milk	Pork	Poultry	Egg	Fish	Total
Manganese	NC	2.51E-12	4.39E-09	NC	NC	NC	NC	NC	NA	4.39E-09
Naphthalene	2.04E-10	2.62E-09	4.58E-07	3.35E-11	6.34E-10	1.35E-11	4.26E-13	1.76E-10	NA	4.62E-07
Phenol	6.50E-08	1.06E-09	1.27E-06	1.97E-12	3.88E-11	7.46E-13	2.22E-14	9.16E-12	NA	1.33E-06
Pyrene	2.89E-10	6.63E-13	2.89E-10	5.77E-10	1.01E-08	3.73E-11	1.34E-15	5.56E-13	NA	1.13E-08
n-Hexane	1.47E-14	2.04E-14	2.45E-12	7.06E-16	1.27E-14	1.26E-16	1.20E-15	1.24E-15	NA	2.50E-12
Antimony	3.19E-08	1.85E-09	1.59E-08	1.46E-09	8.06E-09	NC	NC	NC	NA	5.92E-08
Arsenic	1.06E-09	2.72E-11	2.38E-10	5.85E-11	9.60E-11	NC	NC	NC	NA	1.48E-09
Barium	3.55E-06	1.74E-07	1.55E-06	2.19E-08	2.81E-06	NC	NC	NC	NA	8.11E-06
Cadmium	3.23E-08	4.73E-09	7.31E-08	3.42E-10	1.04E-09	6.89E-11	1.51E-09	3.68E-11	NA	1.13E-07
Chlorine	6.57E-03	1.19E-08	NC	1.83E-08	9.98E-08	NC	NC	NC	NA	6.57E-03
Chromium	3.23E-13	4.90E-09	3.90E-09	1.60E-09	2.06E-08	NC	NC	NC	NA	3.10E-08
Chromium VI	9.81E-09	1.13E-10	1.46E-09	1.01E-09	1.50E-08	NC	NC	NC	NA	2.74E-08
Nickel	2.44E-09	2.77E-10	1.30E-09	8.55E-10	7.74E-09	NC	NC	NC	NA	1.26E-08
Selenium	1.66E-08	1.55E-11	7.27E-10	2.05E-10	2.91E-08	6.09E-10	1.40E-11	1.45E-11	NA	4.72E-08
Silver	1.37E-07	3.29E-10	1.37E-08	3.74E-09	1.38E-06	NC	NC	NC	NA	1.53E-06
Zinc	3.99E-08	4.15E-09	4.58E-08	2.37E-10	4.77E-09	3.35E-11	8.33E-11	8.59E-11	NA	9.51E-08

NC - Not Calculated NA - Not Applicable

Table 56c Estimates of Intake by the Subsistence Fisher for the Drill Tower Scenario

Chemical	Ingestion of: Surface Water	Soil	Vegetation	Beef	Milk	Pork	Poultry	Egg	Fish	Total
Carcinogens										
Benzene	1.32E-11	9.76E-13	9.73E-10	NA	NA	NA	NA	NA	1.91E-11	1.01E-09
Benzo(a)pyrene	3.15E-11	3.83E-10	1.40E-09	NA	NA	NA	NA	NA	1.84E-08	2.02E-08
Benzo[a]anthracene	3.66E-10	5.07E-09	1.88E-08	NA	NA	NA	NA	NA	1.09E-07	1.33E-07
Benzo[b]fluoranthene	7.13E-11	1.93E-09	4.18E-09	NA	NA	NA	NA	NA	4.15E-08	4.77E-08
Benzo[k]fluoranthene	4.17E-11	6.41E-10	1.81E-09	NA	NA	NA	NA	NA	2.43E-08	2.68E-08
Chrysene	7.55E-10	5.67E-09	2.03E-08	NA	NA	NA	NA	NA	2.66E-07	2.93E-07
Dibenz[a,h]anthracene	1.07E-11	4.86E-10	2.34E-09	NA	NA	NA	NA	NA	8.00E-09	1.08E-08
Indeno[1,2,3-cd]pyrene	7.46E-12	7.66E-10	7.32E-09	NA	NA	NA	NA	NA	5.72E-09	1.38E-08
Arsenic	4.75E-10	2.92E-12	4.25E-11	NA	NA	NA	NA	NA	5.55E-10	1.08E-09
Chromium VI	4.39E-09	1.22E-11	2.60E-10	NA	NA	NA	NA	NA	7.71E-10	5.44E-09
Noncarcinogens										
Benzaldehyde	1.60E-10	5.71E-12	1.13E-08	NA	NA	NA	NA	NA	7.31E-11	1.16E-08
Benzene	1.32E-11	9.76E-13	9.73E-10	NA	NA	NA	NA	NA	1.91E-11	1.01E-09
Methyl Ethyl Ketone	1.05E-10	2.49E-13	2.76E-09	NA	NA	NA	NA	NA	5.91E-12	2.87E-09
Styrene	4.99E-12	8.25E-12	2.05E-09	NA	NA	NA	NA	NA	2.90E-11	2.10E-09
Toluene	4.31E-12	8.69E-13	6.44E-10	NA	NA	NA	NA	NA	1.58E-11	6.64E-10
o-Xylene	1.78E-12	7.69E-13	5.87E-10	NA	NA	NA	NA	NA	1.47E-11	6.04E-10
2-Methylnaphthalene	4.46E-13	4.24E-12	2.32E-10	NA	NA	NA	NA	NA	1.03E-11	2.47E-10
Acenaphthene	5.25E-12	1.15E-12	1.99E-10	NA	NA	NA	NA	NA	1.86E-10	3.92E-10
Acenaphthylene	4.75E-11	9.20E-10	3.95E-08	NA	NA	NA	NA	NA	1.62E-10	4.06E-08
Anthracene	5.42E-12	3.73E-10	5.99E-09	NA	NA	NA	NA	NA	8.25E-10	7.19E-09
Benzo(g,h,i)perylene	8.62E-11	2.83E-09	3.38E-09	NA	NA	NA	NA	NA	NC	6.30E-09
Fluoranthene	2.26E-10	4.45E-09	3.46E-08	NA	NA	NA	NA	NA	2.07E-07	2.47E-07
Fluorene	7.52E-12	2.15E-13	5.59E-12	NA	NA	NA	NA	NA	5.28E-10	5.41E-10
Furans	1.40E-12	3.94E-14	4.34E-11	NA	NA	NA	NA	NA	5.20E-13	4.54E-11

Table 56c (continued)

Chemical	Ingestion of: Surface Water	Soil	Vegetation	Beef	Milk	Pork	Poultry	Egg	Fish	Total
Manganese	NC	2.69E-13	7.84E-10	NA	NA	NA	NA	NA	NC	7.84E-10
Naphthalene	9.12E-11	2.81E-10	7.53E-08	NA	NA	NA	NA	NA	1.15E-09	7.69E-08
Phenol	2.91E-08	1.14E-10	2.14E-07	NA	NA	NA	NA	NA	1.33E-08	2.56E-07
Pyrene	1.29E-10	7.11E-14	5.16E-11	NA	NA	NA	NA	NA	9.00E-08	9.02E-08
n-Hexane	6.58E-15	2.18E-15	4.26E-13	NA	NA	NA	NA	NA	7.16E-14	5.07E-13
Antimony	1.43E-08	1.99E-10	2.84E-09	NA	NA	NA	NA	NA	3.34E-08	5.07E-08
Arsenic	4.75E-10	2.92E-12	4.25E-11	NA	NA	NA	NA	NA	5.55E-10	1.08E-09
Barium	1.59E-06	1.86E-08	2.79E-07	NA	NA	NA	NA	NA	5.89E-05	6.08E-05
Cadmium	1.45E-08	5.06E-10	1.32E-08	NA	NA	NA	NA	NA	2.12E-07	2.40E-07
Chlorine	2.94E-03	1.28E-09	NC	NA	NA	NA	NA	NA	NC	2.94E-03
Chromium	1.44E-13	5.25E-10	6.98E-10	NA	NA	NA	NA	NA	1.61E-12	1.22E-09
Chromium VI	4.39E-09	1.22E-11	2.60E-10	NA	NA	NA	NA	NA	7.71E-10	5.44E-09
Nickel	1.09E-09	2.96E-11	2.32E-10	NA	NA	NA	NA	NA	4.99E-09	6.35E-09
Selenium	7.42E-09	1.66E-12	1.30E-10	NA	NA	NA	NA	NA	5.60E-08	6.36E-08
Silver	6.12E-08	3.52E-11	2.46E-09	NA	NA	NA	NA	NA	7.30E-07	7.94E-07
Zinc	1.78E-08	4.44E-10	8.24E-09	NA	NA	NA	NA	NA	2.15E-06	2.18E-06

NC - Not Calculated　　NA - Not Applicable

Table 56d Estimates of Intake by the Subsistence Fisher Child for the Drill Tower Scenario

Chemical	Ingestion of: Surface Water	Soil	Vegetation	Beef	Milk	Pork	Poultry	Egg	Fish	Total
Carcinogens										
Benzene	2.94E-11	9.11E-12	1.46E-09	NA	NA	NA	NA	NA	1.24E-11	1.51E-09
Benzo(a)pyrene	7.04E-11	3.57E-09	1.96E-09	NA	NA	NA	NA	NA	1.19E-08	1.75E-08
Benzo[a]anthracene	8.17E-10	4.73E-08	2.62E-08	NA	NA	NA	NA	NA	7.08E-08	1.45E-07
Benzo[b]fluoranthene	1.59E-10	1.80E-08	5.89E-09	NA	NA	NA	NA	NA	2.69E-08	5.10E-08
Benzo[k]fluoranthene	9.32E-11	5.98E-09	2.55E-09	NA	NA	NA	NA	NA	1.58E-08	2.44E-08
Chrysene	1.69E-09	5.29E-08	2.83E-08	NA	NA	NA	NA	NA	1.73E-07	2.56E-07
Dibenz[a,h]anthracene	2.39E-11	4.53E-09	3.29E-09	NA	NA	NA	NA	NA	5.19E-09	1.30E-08
Indeno[1,2,3-cd]pyrene	1.67E-11	7.15E-09	1.03E-08	NA	NA	NA	NA	NA	3.71E-09	2.12E-08
Arsenic	1.06E-09	2.72E-11	5.94E-11	NA	NA	NA	NA	NA	3.60E-10	1.51E-09
Chromium VI	9.81E-09	1.13E-10	3.64E-10	NA	NA	NA	NA	NA	5.00E-10	1.08E-08
Noncarcinogens										
Benzaldehyde	3.58E-10	5.33E-11	1.68E-08	NA	NA	NA	NA	NA	4.75E-11	1.73E-08
Benzene	2.94E-11	9.11E-12	1.46E-09	NA	NA	NA	NA	NA	1.24E-11	1.51E-09
Methyl Ethyl Ketone	2.35E-10	2.32E-12	4.13E-09	NA	NA	NA	NA	NA	3.84E-12	4.37E-09
Styrene	1.12E-11	7.70E-11	3.03E-09	NA	NA	NA	NA	NA	1.88E-11	3.13E-09
Toluene	9.61E-12	8.11E-12	9.81E-10	NA	NA	NA	NA	NA	1.02E-11	1.01E-09
o-Xylene	3.97E-12	7.18E-12	9.08E-10	NA	NA	NA	NA	NA	9.51E-12	9.29E-10
2-Methylnaphthalene	9.96E-13	3.96E-11	3.28E-10	NA	NA	NA	NA	NA	6.70E-12	3.75E-10
Acenaphthene	1.17E-11	1.08E-11	3.04E-10	NA	NA	NA	NA	NA	1.21E-10	4.48E-10
Acenaphthylene	1.06E-10	8.58E-09	5.62E-08	NA	NA	NA	NA	NA	1.05E-10	6.50E-08
Anthracene	1.21E-11	3.48E-09	8.24E-09	NA	NA	NA	NA	NA	5.35E-10	1.23E-08
Benzo(g,h,i)perylene	1.93E-10	2.64E-08	4.69E-09	NA	NA	NA	NA	NA	NC	3.13E-08
Fluoranthene	5.04E-10	4.16E-08	4.81E-08	NA	NA	NA	NA	NA	1.35E-07	2.25E-07
Fluorene	1.68E-11	2.00E-12	7.71E-12	NA	NA	NA	NA	NA	3.42E-10	3.69E-10
Furans	3.12E-12	3.67E-13	6.05E-11	NA	NA	NA	NA	NA	3.37E-13	6.43E-11

Table 56d (continued)

Chemical	Ingestion of: Surface Water	Soil	Vegetation	Beef	Milk	Pork	Poultry	Egg	Fish	Total
Manganese	NC	2.51E-12	1.10E-09	NA	NA	NA	NA	NA	NC	1.10E-09
Naphthalene	2.04E-10	2.62E-09	1.15E-07	NA	NA	NA	NA	NA	7.44E-10	1.18E-07
Phenol	6.50E-08	1.06E-09	3.17E-07	NA	NA	NA	NA	NA	8.62E-09	3.92E-07
Pyrene	2.89E-10	6.63E-13	7.22E-11	NA	NA	NA	NA	NA	5.84E-08	5.88E-08
n-Hexane	1.47E-14	2.04E-14	6.13E-13	NA	NA	NA	NA	NA	4.65E-14	6.94E-13
Antimony	3.19E-08	1.85E-09	3.98E-09	NA	NA	NA	NA	NA	2.17E-08	5.94E-08
Arsenic	1.06E-09	2.72E-11	5.94E-11	NA	NA	NA	NA	NA	3.60E-10	1.51E-09
Barium	3.55E-06	1.74E-07	3.88E-07	NA	NA	NA	NA	NA	3.82E-05	4.23E-05
Cadmium	3.23E-08	4.73E-09	1.83E-08	NA	NA	NA	NA	NA	1.37E-07	1.93E-07
Chlorine	6.57E-03	1.19E-08	NC	NA	NA	NA	NA	NA	NC	6.57E-03
Chromium	3.23E-13	4.90E-09	9.74E-10	NA	NA	NA	NA	NA	1.04E-12	5.88E-09
Chromium VI	9.81E-09	1.13E-10	3.64E-10	NA	NA	NA	NA	NA	5.00E-10	1.08E-08
Nickel	2.44E-09	2.77E-10	3.24E-10	NA	NA	NA	NA	NA	3.24E-09	6.28E-09
Selenium	1.66E-08	1.55E-11	1.82E-10	NA	NA	NA	NA	NA	3.63E-08	5.31E-08
Silver	1.37E-07	3.29E-10	3.43E-09	NA	NA	NA	NA	NA	4.74E-07	6.14E-07
Zinc	3.99E-08	4.15E-09	1.15E-08	NA	NA	NA	NA	NA	1.40E-06	1.45E-06

NC - Not Calculated NA - Not Applicable

Table 56e Estimates of Intake by the Adult Resident for the Drill Tower Scenario

	Ingestion of:									
Chemical	Surface Water	Soil	Vegetation	Beef	Milk	Pork	Poultry	Egg	Fish	Total
Carcinogens										
Benzene	1.32E-11	9.76E-13	9.73E-10	NA	NA	NA	NA	NA	NA	9.88E-10
Benzo(a)pyrene	3.15E-11	3.83E-10	1.40E-09	NA	NA	NA	NA	NA	NA	1.82E-09
Benzo[a]anthracene	3.66E-10	5.07E-09	1.88E-08	NA	NA	NA	NA	NA	NA	2.42E-08
Benzo[b]fluoranthene	7.13E-11	1.93E-09	4.18E-09	NA	NA	NA	NA	NA	NA	6.18E-09
Benzo[k]fluoranthene	4.17E-11	6.41E-10	1.81E-09	NA	NA	NA	NA	NA	NA	2.49E-09
Chrysene	7.55E-10	5.67E-09	2.03E-08	NA	NA	NA	NA	NA	NA	2.67E-08
Dibenz[a,h]anthracene	1.07E-11	4.86E-10	2.34E-09	NA	NA	NA	NA	NA	NA	2.84E-09
Indeno[1,2,3-cd]pyrene	7.46E-12	7.66E-10	7.32E-09	NA	NA	NA	NA	NA	NA	8.10E-09
Arsenic	4.75E-10	2.92E-12	4.25E-11	NA	NA	NA	NA	NA	NA	5.20E-10
Chromium VI	4.39E-09	1.22E-11	2.60E-10	NA	NA	NA	NA	NA	NA	4.67E-09
Noncarcinogens										
Benzaldehyde	1.60E-10	5.71E-12	1.13E-08	NA	NA	NA	NA	NA	NA	1.15E-08
Benzene	1.32E-11	9.76E-13	9.73E-10	NA	NA	NA	NA	NA	NA	9.88E-10
Methyl Ethyl Ketone	1.05E-10	2.49E-13	2.76E-09	NA	NA	NA	NA	NA	NA	2.86E-09
Styrene	4.99E-12	8.25E-12	2.05E-09	NA	NA	NA	NA	NA	NA	2.07E-09
Toluene	4.31E-12	8.69E-13	6.44E-10	NA	NA	NA	NA	NA	NA	6.49E-10
o-Xylene	1.78E-12	7.69E-13	5.87E-10	NA	NA	NA	NA	NA	NA	5.90E-10
2-Methylnaphthalene	4.46E-13	4.24E-12	2.32E-10	NA	NA	NA	NA	NA	NA	2.36E-10
Acenaphthene	5.25E-12	1.15E-12	1.99E-10	NA	NA	NA	NA	NA	NA	2.06E-10
Acenaphthylene	4.75E-11	9.20E-10	3.95E-08	NA	NA	NA	NA	NA	NA	4.04E-08
Anthracene	5.42E-12	3.73E-10	5.99E-09	NA	NA	NA	NA	NA	NA	6.37E-09
Benzo(g,h,i)perylene	8.62E-11	2.83E-09	3.38E-09	NA	NA	NA	NA	NA	NA	6.30E-09
Fluoranthene	2.26E-10	4.45E-09	3.46E-08	NA	NA	NA	NA	NA	NA	3.92E-08
Fluorene	7.52E-12	2.15E-13	5.59E-12	NA	NA	NA	NA	NA	NA	1.33E-11
Furans	1.40E-12	3.94E-14	4.34E-11	NA	NA	NA	NA	NA	NA	4.49E-11

Table 56e (continued)

Chemical	Ingestion of: Surface Water	Soil	Vegetation	Beef	Milk	Pork	Poultry	Egg	Fish	Total
Manganese	NC	2.69E-13	7.84E-10	NA	NA	NA	NA	NA	NA	7.84E-10
Naphthalene	9.12E-11	2.81E-10	7.53E-08	NA	NA	NA	NA	NA	NA	7.57E-08
Phenol	2.91E-08	1.14E-10	2.14E-07	NA	NA	NA	NA	NA	NA	2.43E-07
Pyrene	1.29E-10	7.11E-14	5.16E-11	NA	NA	NA	NA	NA	NA	1.81E-10
n-Hexane	6.58E-15	2.18E-15	4.26E-13	NA	NA	NA	NA	NA	NA	4.35E-13
Antimony	1.43E-08	1.99E-10	2.84E-09	NA	NA	NA	NA	NA	NA	1.73E-08
Arsenic	4.75E-10	2.92E-12	4.25E-11	NA	NA	NA	NA	NA	NA	5.20E-10
Barium	1.59E-06	1.86E-08	2.79E-07	NA	NA	NA	NA	NA	NA	1.89E-06
Cadmium	1.45E-08	5.06E-10	1.32E-08	NA	NA	NA	NA	NA	NA	2.82E-08
Chlorine	2.94E-03	1.28E-09	NC	NA	NA	NA	NA	NA	NA	2.94E-03
Chromium	1.44E-13	5.25E-10	6.98E-10	NA	NA	NA	NA	NA	NA	1.22E-09
Chromium VI	4.39E-09	1.22E-11	2.60E-10	NA	NA	NA	NA	NA	NA	4.67E-09
Nickel	1.09E-09	2.96E-11	2.32E-10	NA	NA	NA	NA	NA	NA	1.36E-09
Selenium	7.42E-09	1.66E-12	1.30E-10	NA	NA	NA	NA	NA	NA	7.55E-09
Silver	6.12E-08	3.52E-11	2.46E-09	NA	NA	NA	NA	NA	NA	6.37E-08
Zinc	1.78E-08	4.44E-10	8.24E-09	NA	NA	NA	NA	NA	NA	2.65E-08

NC - Not Calculated NA - Not Applicable

Table 56f Estimates of Intake by the Child Resident for the Drill Tower Scenario

Chemical	Ingestion of: Surface Water	Soil	Vegetation	Beef	Milk	Pork	Poultry	Egg	Fish	Total
Carcinogens										
Benzene	2.94E-11	9.11E-12	1.46E-09	NA	NA	NA	NA	NA	NA	1.50E-09
Benzo(a)pyrene	7.04E-11	3.57E-09	1.96E-09	NA	NA	NA	NA	NA	NA	5.60E-09
Benzo[a]anthracene	8.17E-10	4.73E-08	2.62E-08	NA	NA	NA	NA	NA	NA	7.43E-08
Benzo[b]fluoranthene	1.59E-10	1.80E-08	5.89E-09	NA	NA	NA	NA	NA	NA	2.41E-08
Benzo[k]fluoranthene	9.32E-11	5.98E-09	2.55E-09	NA	NA	NA	NA	NA	NA	8.62E-09
Chrysene	1.69E-09	5.29E-08	2.83E-08	NA	NA	NA	NA	NA	NA	8.29E-08
Dibenz[a,h]anthracene	2.39E-11	4.53E-09	3.29E-09	NA	NA	NA	NA	NA	NA	7.85E-09
Indeno[1,2,3-cd]pyrene	1.67E-11	7.15E-09	1.03E-08	NA	NA	NA	NA	NA	NA	1.74E-08
Arsenic	1.06E-09	2.72E-11	5.94E-11	NA	NA	NA	NA	NA	NA	1.15E-09
Chromium VI	9.81E-09	1.13E-10	3.64E-10	NA	NA	NA	NA	NA	NA	1.03E-08
Noncarcinogens										
Benzaldehyde	3.58E-10	5.33E-11	1.68E-08	NA	NA	NA	NA	NA	NA	1.72E-08
Benzene	2.94E-11	9.11E-12	1.46E-09	NA	NA	NA	NA	NA	NA	1.50E-09
Methyl Ethyl Ketone	2.35E-10	2.32E-12	4.13E-09	NA	NA	NA	NA	NA	NA	4.36E-09
Styrene	1.12E-11	7.70E-11	3.03E-09	NA	NA	NA	NA	NA	NA	3.12E-09
Toluene	9.61E-12	8.11E-12	9.81E-10	NA	NA	NA	NA	NA	NA	9.99E-10
o-Xylene	3.97E-12	7.18E-12	9.08E-10	NA	NA	NA	NA	NA	NA	9.19E-10
2-Methylnaphthalene	9.96E-13	3.96E-11	3.28E-10	NA	NA	NA	NA	NA	NA	3.69E-10
Acenaphthene	1.17E-11	1.08E-11	3.04E-10	NA	NA	NA	NA	NA	NA	3.27E-10
Acenaphthylene	1.06E-10	8.58E-09	5.62E-08	NA	NA	NA	NA	NA	NA	6.49E-08
Anthracene	1.21E-11	3.48E-09	8.24E-09	NA	NA	NA	NA	NA	NA	1.17E-08
Benzo(g,h,i)perylene	1.93E-10	2.64E-08	4.69E-09	NA	NA	NA	NA	NA	NA	3.13E-08
Fluoranthene	5.04E-10	4.16E-08	4.81E-08	NA	NA	NA	NA	NA	NA	9.02E-08
Fluorene	1.68E-11	2.00E-12	7.71E-12	NA	NA	NA	NA	NA	NA	2.65E-11
Furans	3.12E-12	3.67E-13	6.05E-11	NA	NA	NA	NA	NA	NA	6.40E-11

Table 56f (continued)

Chemical	Ingestion of: Surface Water	Soil	Vegetation	Beef	Milk	Pork	Poultry	Egg	Fish	Total
Manganese	NC	2.51E-12	1.10E-09	NA	NA	NA	NA	NA	NA	1.10E-09
Naphthalene	2.04E-10	2.62E-09	1.15E-07	NA	NA	NA	NA	NA	NA	1.17E-07
Phenol	6.50E-08	1.06E-09	3.17E-07	NA	NA	NA	NA	NA	NA	3.83E-07
Pyrene	2.89E-10	6.63E-13	7.22E-11	NA	NA	NA	NA	NA	NA	3.62E-10
n-Hexane	1.47E-14	2.04E-14	6.13E-13	NA	NA	NA	NA	NA	NA	6.48E-13
Antimony	3.19E-08	1.85E-09	3.98E-09	NA	NA	NA	NA	NA	NA	3.77E-08
Arsenic	1.06E-09	2.72E-11	5.94E-11	NA	NA	NA	NA	NA	NA	1.15E-09
Barium	3.55E-06	1.74E-07	3.88E-07	NA	NA	NA	NA	NA	NA	4.12E-06
Cadmium	3.23E-08	4.73E-09	1.83E-08	NA	NA	NA	NA	NA	NA	5.53E-08
Chlorine	6.57E-03	1.19E-08	NC	NA	NA	NA	NA	NA	NA	6.57E-03
Chromium	3.23E-13	4.90E-09	9.74E-10	NA	NA	NA	NA	NA	NA	5.88E-09
Chromium VI	9.81E-09	1.13E-10	3.64E-10	NA	NA	NA	NA	NA	NA	1.03E-08
Nickel	2.44E-09	2.77E-10	3.24E-10	NA	NA	NA	NA	NA	NA	3.04E-09
Selenium	1.66E-08	1.55E-11	1.82E-10	NA	NA	NA	NA	NA	NA	1.68E-08
Silver	1.37E-07	3.29E-10	3.43E-09	NA	NA	NA	NA	NA	NA	1.40E-07
Zinc	3.99E-08	4.15E-09	1.15E-08	NA	NA	NA	NA	NA	NA	5.55E-08

NC - Not Calculated NA - Not Applicable

Table 57a Estimates of Risk and Hazard Due to Inhalation for the ARFF Scenario

Chemical	Subsistence Farmer	Subsistence Farmer Child	Subsistence Fisher	Subsistence Fisher Child	Adult Resident	Child Resident	Facility Worker
Carcinogens (risks)							
Acetaldehyde	7.04E-14	2.35E-14	5.28E-14	2.35E-14	5.28E-14	2.35E-14	2.49E-14
Benzene	4.53E-14	1.51E-14	3.40E-14	1.51E-14	3.40E-14	1.51E-14	1.60E-14
Methylene Chloride	5.76E-14	1.92E-14	4.32E-14	1.92E-14	4.32E-14	1.92E-14	2.04E-14
Tetrachloroethylene	1.23E-15	4.09E-16	9.21E-16	4.09E-16	9.21E-16	4.09E-16	4.35E-16
Benzo[a]anthracene	2.45E-14	8.16E-15	1.84E-14	8.16E-15	1.84E-14	8.16E-15	8.68E-15
Benzo[b]fluoranthene	2.69E-14	8.96E-15	2.02E-14	8.96E-15	2.02E-14	8.96E-15	9.53E-15
Chrysene	1.73E-16	5.75E-17	1.29E-16	5.75E-17	1.29E-16	5.75E-17	6.11E-17
Dibenz[a,h]anthracene	6.52E-14	2.17E-14	4.89E-14	2.17E-14	4.89E-14	2.17E-14	2.31E-14
Formaldehyde	1.51E-12	5.02E-13	1.13E-12	5.02E-13	1.13E-12	5.02E-13	5.34E-13
Indeno[1,2,3-cd]pyrene	1.96E-14	6.53E-15	1.47E-14	6.53E-15	1.47E-14	6.53E-15	6.94E-15
2,3,7,8-TCDDioxin Toxicity Equivalents	5.18E-11	1.73E-11	3.88E-11	1.73E-11	3.88E-11	1.73E-11	1.83E-11
Arsenic	2.79E-10	9.32E-11	2.10E-10	9.32E-11	2.10E-10	9.32E-11	9.90E-11
Beryllium	1.38E-11	4.61E-12	1.04E-11	4.61E-12	1.04E-11	4.61E-12	4.90E-12
Cadmium	7.67E-12	2.56E-12	5.75E-12	2.56E-12	5.75E-12	2.56E-12	2.72E-12
Chromium VI	7.96E-10	2.65E-10	5.97E-10	2.65E-10	5.97E-10	2.65E-10	2.82E-10
Nickel	2.66E-09	8.87E-10	1.99E-09	8.87E-10	1.99E-09	8.87E-10	9.42E-10
Total	3.81E-09	1.27E-09	2.86E-09	1.27E-09	2.86E-09	1.27E-09	1.35E-09
Noncarcinogens (hazards)							
Acetaldehyde	6.15E-09	1.37E-08	6.15E-09	1.37E-08	6.15E-09	1.37E-08	2.91E-09
Benzene	1.61E-10	3.57E-10	1.61E-10	3.57E-10	1.61E-10	3.57E-10	7.59E-11
Ethylbenzene	9.57E-12	2.13E-11	9.57E-12	2.13E-11	9.57E-12	2.13E-11	4.52E-12
Methyl Chloroform	4.24E-10	9.42E-10	4.24E-10	9.42E-10	4.24E-10	9.42E-10	2.00E-10
Methylene Chloride	1.05E-09	2.33E-09	1.05E-09	2.33E-09	1.05E-09	2.33E-09	4.96E-10
Tetrachloroethylene	1.07E-10	2.39E-10	1.07E-10	2.39E-10	1.07E-10	2.39E-10	5.08E-11

Table 57a (continued)

Chemical	Subsistence Farmer	Subsistence Farmer Child	Subsistence Fisher	Subsistence Fisher Child	Adult Resident	Child Resident	Facility Worker
Toluene	7.81E-11	1.74E-10	7.81E-11	1.74E-10	7.81E-11	1.74E-10	3.69E-11
Vinyl Acetate	1.00E-11	2.23E-11	1.00E-11	2.23E-11	1.00E-11	2.23E-11	4.75E-12
o-Xylene	8.20E-13	1.82E-12	8.20E-13	1.82E-12	8.20E-13	1.82E-12	3.87E-13
p-Xylene	1.32E-12	2.93E-12	1.32E-12	2.93E-12	1.32E-12	2.93E-12	6.23E-13
2-Methylnaphthalene	8.29E-13	1.84E-12	8.29E-13	1.84E-12	8.29E-13	1.84E-12	3.92E-13
Acenaphthene	1.17E-11	2.59E-11	1.17E-11	2.59E-11	1.17E-11	2.59E-11	5.51E-12
Acenaphthylene	5.53E-13	1.23E-12	5.53E-13	1.23E-12	5.53E-13	1.23E-12	2.61E-13
Anthracene	9.74E-14	2.16E-13	9.74E-14	2.16E-13	9.74E-14	2.16E-13	4.60E-14
Benzo(g,h,i)perylene	1.37E-12	3.04E-12	1.37E-12	3.04E-12	1.37E-12	3.04E-12	6.47E-13
Fluoranthene	7.82E-13	1.74E-12	7.82E-13	1.74E-12	7.82E-13	1.74E-12	3.70E-13
Fluorene	1.03E-12	2.28E-12	1.03E-12	2.28E-12	1.03E-12	2.28E-12	4.85E-13
Formaldehyde	2.93E-10	6.51E-10	2.93E-10	6.51E-10	2.93E-10	6.51E-10	1.38E-10
Manganese	2.40E-10	5.33E-10	2.40E-10	5.33E-10	2.40E-10	5.33E-10	1.13E-10
Naphthalene	3.32E-11	7.37E-11	3.32E-11	7.37E-11	3.32E-11	7.37E-11	1.57E-11
Phenol	7.92E-11	1.76E-10	7.92E-11	1.76E-10	7.92E-11	1.76E-10	3.74E-11
Pyrene	2.41E-12	5.35E-12	2.41E-12	5.35E-12	2.41E-12	5.35E-12	1.14E-12
Arsenic	1.09E-07	2.42E-07	1.09E-07	2.42E-07	1.09E-07	2.42E-07	5.13E-08
Beryllium	1.44E-09	3.20E-09	1.44E-09	3.20E-09	1.44E-09	3.20E-09	6.81E-10
Cadmium	2.07E-09	4.60E-09	2.07E-09	4.60E-09	2.07E-09	4.60E-09	9.77E-10
Chlorine	1.40E-07	3.11E-07	1.40E-07	3.11E-07	1.40E-07	3.11E-07	6.61E-08
Chromium	2.21E-11	4.91E-11	2.21E-11	4.91E-11	2.21E-11	4.91E-11	1.04E-11
Chromium VI	1.11E-08	2.46E-08	1.11E-08	2.46E-08	1.11E-08	2.46E-08	5.22E-09
Nickel	1.39E-07	3.08E-07	1.39E-07	3.08E-07	1.39E-07	3.08E-07	6.54E-08
Selenium	2.03E-09	4.51E-09	2.03E-09	4.51E-09	2.03E-09	4.51E-09	9.58E-10

Table 57b Estimates of Risk and Hazard Due to Inhalation for the Propane Scenario

Chemical	Subsistence Farmer	Subsistence Farmer Child	Subsistence Fisher	Subsistence Fisher Child	Adult Resident	Child Resident	Facility Worker
Carcinogens (risks)							
Benzene	3.86E-13	1.29E-13	2.89E-13	1.29E-13	2.89E-13	1.29E-13	1.37E-13
Formaldehyde	1.24E-11	4.14E-12	9.31E-12	4.14E-12	9.31E-12	4.14E-12	4.40E-12
Arsenic	3.88E-12	1.29E-12	2.91E-12	1.29E-12	2.91E-12	1.29E-12	1.37E-12
Nickel	2.25E-11	7.52E-12	1.69E-11	7.52E-12	1.69E-11	7.52E-12	7.99E-12
Total	3.92E-11	1.31E-11	2.94E-11	1.31E-11	2.94E-11	1.31E-11	1.39E-11
Noncarcinogens (hazards)							
Benzene	1.37E-09	3.04E-09	1.37E-09	3.04E-09	1.37E-09	3.04E-09	6.47E-10
Toluene	8.48E-10	1.88E-09	8.48E-10	1.88E-09	8.48E-10	1.88E-09	4.00E-10
2-Methylnaphthalene	1.08E-11	2.40E-11	1.08E-11	2.40E-11	1.08E-11	2.40E-11	5.11E-12
Fluoranthene	1.25E-12	2.77E-12	1.25E-12	2.77E-12	1.25E-12	2.77E-12	5.89E-13
Fluorene	1.25E-12	2.77E-12	1.25E-12	2.77E-12	1.25E-12	2.77E-12	5.89E-13
Formaldehyde	2.41E-09	5.36E-09	2.41E-09	5.36E-09	2.41E-09	5.36E-09	1.14E-09
Naphthalene	5.56E-10	1.24E-09	5.56E-10	1.24E-09	5.56E-10	1.24E-09	2.63E-10
Pyrene	2.77E-12	6.15E-12	2.77E-12	6.15E-12	2.77E-12	6.15E-12	1.31E-12
Arsenic	1.51E-09	3.35E-09	1.51E-09	3.35E-09	1.51E-09	3.35E-09	7.13E-10
Nickel	1.17E-09	2.61E-09	1.17E-09	2.61E-09	1.17E-09	2.61E-09	5.55E-10

Table 57c Estimates of Risk and Hazard Due to Inhalation for the Drill Tower Scenario

Chemical	Subsistence Farmer	Subsistence Farmer Child	Subsistence Fisher	Subsistence Fisher Child	Adult Resident	Child Resident	Facility Worker
Carcinogens (risks)							
Benzene	7.87E-09	2.62E-09	5.91E-09	2.62E-09	5.91E-09	2.62E-09	2.79E-09
Benzo(a)pyrene	4.68E-09	1.56E-09	3.51E-09	1.56E-09	3.51E-09	1.56E-09	1.66E-09
Benzo[a]anthracene	2.28E-09	7.61E-10	1.71E-09	7.61E-10	1.71E-09	7.61E-10	8.09E-10
Benzo[b]flouranthene	9.69E-10	3.23E-10	7.27E-10	3.23E-10	7.27E-10	3.23E-10	3.43E-10
Benzo[k]fluoranthene	3.39E-11	1.13E-11	2.55E-11	1.13E-11	2.55E-11	1.13E-11	1.20E-11
Chrysene	2.05E-11	6.84E-12	1.54E-11	6.84E-12	1.54E-11	6.84E-12	7.27E-12
Dibenz[a,h]anthracene	1.29E-09	4.31E-10	9.70E-10	4.31E-10	9.70E-10	4.31E-10	4.58E-10
Indeno[1,2,3-cd]pyrene	2.53E-10	8.44E-11	1.90E-10	8.44E-11	1.90E-10	8.44E-11	8.97E-11
Arsenic	9.79E-11	3.26E-11	7.34E-11	3.26E-11	7.34E-11	3.26E-11	3.47E-11
Cadmium	2.85E-09	9.50E-10	2.14E-09	9.50E-10	2.14E-09	9.50E-10	1.01E-09
Chromium VI	1.73E-09	5.76E-10	1.30E-09	5.76E-10	1.30E-09	5.76E-10	6.13E-10
Nickel	5.10E-11	1.70E-11	3.82E-11	1.70E-11	3.82E-11	1.70E-11	1.81E-11
Total	2.21E-08	7.38E-09	1.66E-08	7.38E-09	1.66E-08	7.38E-09	7.84E-09
Noncarcinogens (hazards)							
Benzaldehyde	4.11E-07	9.13E-07	4.11E-07	9.13E-07	4.11E-07	9.13E-07	1.94E-07
Benzene	2.79E-05	6.21E-05	2.79E-05	6.21E-05	2.79E-05	6.21E-05	1.32E-05
Methyl Ethyl Ketone (MEK)	4.09E-08	9.10E-08	4.09E-08	9.10E-08	4.09E-08	9.10E-08	1.93E-08
Styrene	5.48E-07	1.22E-06	5.48E-07	1.22E-06	5.48E-07	1.22E-06	2.59E-07
Toluene	8.69E-07	1.93E-06	8.69E-07	1.93E-06	8.69E-07	1.93E-06	4.11E-07
o-Xylene	3.55E-08	7.88E-08	3.55E-08	7.88E-08	3.55E-08	7.88E-08	1.68E-08
2-Methylnaphthalene	3.22E-08	7.16E-08	3.22E-08	7.16E-08	3.22E-08	7.16E-08	1.52E-08
Acenaphthene	1.07E-07	2.37E-07	1.07E-07	2.37E-07	1.07E-07	2.37E-07	5.04E-08
Acenaphthylene	5.49E-07	1.22E-06	5.49E-07	1.22E-06	5.49E-07	1.22E-06	2.59E-07
Anthracene	1.12E-08	2.49E-08	1.12E-08	2.49E-08	1.12E-08	2.49E-08	5.29E-09

Table 57c (continued)

Chemical	Subsistence Farmer	Subsistence Farmer Child	Subsistence Fisher	Subsistence Fisher Child	Adult Resident	Child Resident	Facility Worker
Benzo(g,h,i)perylene	6.48E-08	1.44E-07	6.48E-08	1.44E-07	6.48E-08	1.44E-07	3.06E-08
Fluoranthene	2.08E-07	4.62E-07	2.08E-07	4.62E-07	2.08E-07	4.62E-07	9.82E-08
Fluorene	9.10E-08	2.02E-07	9.10E-08	2.02E-07	9.10E-08	2.02E-07	4.30E-08
Furans	4.96E-05	1.10E-04	4.96E-05	1.10E-04	4.96E-05	1.10E-04	2.34E-05
Manganese	1.62E-09	3.59E-09	1.62E-09	3.59E-09	1.62E-09	3.59E-09	7.63E-10
Naphthalene	1.44E-05	3.19E-05	1.44E-05	3.19E-05	1.44E-05	3.19E-05	6.79E-06
Phenol	9.58E-08	2.13E-07	9.58E-08	2.13E-07	9.58E-08	2.13E-07	4.53E-08
Pyrene	2.43E-07	5.39E-07	2.43E-07	5.39E-07	2.43E-07	5.39E-07	1.15E-07
n-Hexane	8.00E-07	1.78E-06	8.00E-07	1.78E-06	8.00E-07	1.78E-06	3.78E-07
Antimony	1.27E-06	2.82E-06	1.27E-06	2.82E-06	1.27E-06	2.82E-06	5.99E-07
Arsenic	3.81E-08	8.46E-08	3.81E-08	8.46E-08	3.81E-08	8.46E-08	1.80E-08
Barium	7.44E-07	1.65E-06	7.44E-07	1.65E-06	7.44E-07	1.65E-06	3.51E-07
Cadmium	7.68E-07	1.71E-06	7.68E-07	1.71E-06	7.68E-07	1.71E-06	3.63E-07
Chlorine	1.17E-05	2.60E-05	1.17E-05	2.60E-05	1.17E-05	2.60E-05	5.52E-06
Chromium	4.80E-11	1.07E-10	4.80E-11	1.07E-10	4.80E-11	1.07E-10	2.27E-11
Chromium VI	2.40E-08	5.34E-08	2.40E-08	5.34E-08	2.40E-08	5.34E-08	1.13E-08
Nickel	2.66E-09	5.90E-09	2.66E-09	5.90E-09	2.66E-09	5.90E-09	1.25E-09
Selenium	7.26E-09	1.61E-08	7.26E-09	1.61E-08	7.26E-09	1.61E-08	3.43E-09
Silver	9.41E-08	2.09E-07	9.41E-08	2.09E-07	9.41E-08	2.09E-07	4.44E-08
Zinc	2.78E-09	6.17E-09	2.78E-09	6.17E-09	2.78E-09	6.17E-09	1.31E-09

Table 58a Estimates of Risk and Hazard by the Subsistence Farmer for the ARFF Scenario

Chemical	Ingestion of: Surface Water	Soil	Vegetation	Beef	Milk	Pork	Poultry	Egg	Fish	Total
Carcinogens (risks)										
Acetaldehyde	2.72E-10	6.45E-17	6.32E-12	4.75E-19	1.91E-18	1.07E-17	3.41E-21	1.39E-18	NA	2.78E-10
Benzene	2.60E-18	7.26E-20	2.90E-16	5.39E-21	2.16E-20	1.23E-21	3.98E-23	1.62E-20	NA	2.92E-16
Methylene Chloride	3.55E-17	2.17E-19	2.76E-15	6.75E-21	2.71E-20	1.52E-21	4.89E-23	1.99E-20	NA	2.80E-15
Tetrachloroethylene	5.75E-19	1.13E-19	2.05E-16	1.27E-20	5.02E-20	2.93E-21	9.53E-23	3.88E-20	NA	2.06E-16
Benzo[a]anthracene	3.06E-15	1.90E-14	2.80E-13	NC	NC	NC	NC	NC	NA	3.02E-13
Benzo[b]flouranthene	1.54E-15	1.85E-14	1.56E-13	NC	NC	NC	NC	NC	NA	1.76E-13
Chrysene	4.95E-17	1.70E-16	2.39E-15	NC	NC	NC	NC	NC	NA	2.61E-15
Dibenz[a,h]anthracene	6.56E-16	6.89E-15	4.66E-13	NC	NC	NC	NC	NC	NA	4.74E-13
Formaldehyde	1.81E-15	4.72E-19	1.90E-14	6.04E-21	2.43E-20	1.36E-21	4.34E-23	1.77E-20	NA	2.08E-14
Indeno[1,2,3-cd]pyrene	6.56E-17	1.55E-15	4.42E-13	NC	NC	NC	NC	NC	NA	4.44E-13
2,3,7,8-TCDDioxin Toxicity Equivalents	3.97E-14	1.80E-12	8.12E-12	1.34E-10	2.52E-10	1.57E-11	1.88E-10	1.60E-10	NA	7.59E-10
Arsenic	2.66E-10	3.80E-13	1.04E-11	7.52E-12	2.48E-12	NC	NC	NC	NA	2.87E-10
Beryllium	1.34E-11	4.02E-12	1.56E-11	5.59E-12	4.91E-14	NC	NC	NC	NA	3.88E-11
Total by Pathway	5.52E-10	6.25E-12	4.18E-11	1.47E-10	2.55E-10	1.57E-11	1.88E-10	1.60E-10	NA	1.36E-09
Noncarcinogens (hazards)										
Acetaldehyde	2.38E-05	5.64E-12	5.53E-07	4.15E-14	1.67E-13	9.35E-13	2.98E-16	1.22E-13	NA	2.43E-05
Benzene	9.22E-15	2.58E-16	1.03E-12	1.91E-17	7.65E-17	4.37E-18	1.41E-19	5.76E-17	NA	1.04E-12
Ethylbenzene	3.86E-16	5.49E-17	1.93E-13	1.14E-17	4.40E-17	2.65E-18	8.84E-20	3.59E-17	NA	1.93E-13
Methyl Chloroform	7.08E-15	1.09E-12	1.02E-09	1.07E-13	4.27E-13	2.47E-14	8.04E-16	3.28E-13	NA	1.03E-09
Methylene Chloride	1.38E-13	8.43E-16	1.07E-11	2.62E-17	1.05E-16	5.92E-18	1.90E-19	7.74E-17	NA	1.09E-11
Tetrachloroethylene	1.94E-15	3.80E-16	6.90E-13	4.26E-17	1.69E-16	9.85E-18	3.21E-19	1.31E-16	NA	6.93E-13
Toluene	4.00E-15	3.05E-16	9.03E-13	3.89E-17	1.53E-16	8.92E-18	2.93E-19	1.19E-16	NA	9.08E-13
Vinyl Acetate	5.74E-15	1.52E-17	3.54E-13	2.75E-19	1.10E-18	6.18E-20	1.98E-21	8.05E-19	NA	3.60E-13
o-Xylene	4.23E-17	6.94E-18	2.12E-14	1.45E-18	5.60E-18	3.38E-19	1.13E-20	4.58E-18	NA	2.13E-14

Table 58a (continued)

	Ingestion of:									
Chemical	Surface Water	Soil	Vegetation	Beef	Milk	Pork	Poultry	Egg	Fish	Total
p-Xylene	9.61E-16	1.48E-21	3.74E-17	4.41E-20	1.57E-19	1.79E-21	2.52E-24	1.03E-21	NA	9.99E-16
2-Methylnaphthalene	5.87E-16	2.13E-15	4.66E-13	2.64E-16	9.90E-15	2.07E-16	2.92E-15	2.96E-15	NA	4.85E-13
Acenaphthene	1.96E-14	1.64E-15	1.15E-12	1.46E-15	5.27E-15	2.45E-16	7.89E-18	3.21E-15	NA	1.18E-12
Acenaphthylene	1.61E-15	1.21E-14	2.07E-12	1.94E-15	7.08E-14	1.57E-15	2.24E-14	2.28E-14	NA	2.21E-12
Anthracene	3.10E-16	8.51E-15	5.46E-13	8.59E-15	2.91E-14	2.40E-15	8.97E-17	3.65E-14	NA	6.32E-13
Benzo(g,h,i)perylene	1.33E-13	1.62E-12	6.51E-12	NC	NC	NC	NC	NC	NA	8.26E-12
Fluoranthene	4.00E-14	3.41E-13	1.06E-11	NC	NC	NC	NC	NC	NA	1.10E-11
Fluorene	4.34E-15	4.73E-17	4.89E-15	3.95E-16	1.40E-15	2.26E-17	3.08E-19	1.25E-16	NA	1.12E-14
Formaldehyde	3.52E-13	9.18E-17	3.69E-12	1.17E-18	4.73E-18	2.64E-19	8.44E-21	3.44E-18	NA	4.04E-12
Manganese	NC	1.49E-14	1.54E-10	NC	NC	NC	NC	NC	NA	1.54E-10
Naphthalene	2.15E-14	2.53E-14	2.72E-11	6.76E-15	2.59E-14	1.63E-15	5.51E-17	2.24E-14	NA	2.73E-11
Phenol	7.34E-11	1.22E-13	9.20E-10	4.73E-15	1.89E-14	1.07E-15	3.43E-17	1.39E-14	NA	9.94E-10
Pyrene	8.72E-14	1.83E-17	4.99E-14	3.94E-13	1.40E-12	1.53E-14	4.98E-19	2.03E-16	NA	1.94E-12
Arsenic	1.04E-06	1.48E-09	4.03E-08	2.93E-08	9.66E-09	NC	NC	NC	NA	1.12E-06
Beryllium	1.40E-09	4.19E-10	1.63E-09	5.82E-10	5.11E-12	NC	NC	NC	NA	4.04E-09
Cadmium	8.84E-09	7.26E-11	7.31E-09	9.79E-11	6.07E-11	1.28E-11	3.11E-10	7.46E-12	NA	1.67E-08
Chlorine	5.74E-04	1.20E-10	NC	3.82E-09	4.23E-09	NC	NC	NC	NA	5.74E-04
Chromium	1.56E-14	1.41E-11	6.22E-11	6.80E-11	1.65E-10	NC	NC	NC	NA	3.09E-10
Chromium VI	1.54E-07	9.88E-11	7.45E-09	1.61E-08	4.87E-08	NC	NC	NC	NA	2.27E-07
Nickel	6.63E-07	4.21E-09	1.16E-07	2.34E-07	4.29E-07	NC	NC	NC	NA	1.45E-06
Selenium	9.45E-08	4.86E-12	6.92E-10	5.80E-10	1.66E-08	1.11E-09	5.91E-11	6.01E-11	NA	1.14E-07

NC - Not Calculated   NA - Not Applicable

Table 58b Estimates of Risk and Hazard by the Subsistence Farmer Child for the ARFF Scenario

Chemical	Ingestion of: Surface Water	Soil	Vegetation	Beef	Milk	Pork	Poultry	Egg	Fish	Total
Carcinogens (risks)										
Acetaldehyde	1.21E-10	1.20E-16	1.90E-12	4.25E-20	8.45E-19	1.61E-18	4.75E-22	1.97E-19	NA	1.23E-10
Benzene	8.70E-19	1.36E-19	8.70E-17	4.82E-22	9.50E-21	1.85E-22	5.55E-24	2.29E-21	NA	8.80E-17
Methylene Chloride	1.19E-17	4.05E-19	8.28E-16	6.04E-22	1.20E-20	2.29E-22	6.81E-24	2.81E-21	NA	8.40E-16
Tetrachloroethylene	1.93E-19	2.11E-19	6.08E-17	1.13E-21	2.21E-20	4.39E-22	1.33E-23	5.48E-21	NA	6.12E-17
Benzo[a]anthracene	1.14E-15	3.26E-14	7.14E-14	NC	NC	NC	NC	NC	NA	1.05E-13
Benzo[b]flouranthene	5.71E-16	3.18E-14	4.01E-14	NC	NC	NC	NC	NC	NA	7.25E-14
Chrysene	1.83E-17	2.80E-16	5.88E-16	NC	NC	NC	NC	NC	NA	8.86E-16
Dibenz[a,h]anthracene	2.52E-16	1.14E-14	9.94E-14	NC	NC	NC	NC	NC	NA	1.11E-13
Formaldehyde	6.07E-16	8.81E-19	5.67E-15	5.41E-22	1.07E-20	2.04E-22	6.05E-24	2.50E-21	NA	6.28E-15
Indeno[1,2,3-cd]pyrene	2.57E-17	2.63E-15	9.30E-14	NC	NC	NC	NC	NC	NA	9.57E-14
2,3,7,8-TCDDioxin Toxicity Equivalents	1.31E-14	2.48E-12	1.70E-12	8.98E-12	8.30E-11	1.75E-12	1.93E-11	1.66E-11	NA	1.34E-10
Arsenic	1.11E-10	6.97E-13	2.29E-12	5.17E-13	8.37E-13	NC	NC	NC	NA	1.15E-10
Beryllium	4.41E-12	5.51E-12	3.23E-12	3.72E-13	1.61E-14	NC	NC	NC	NA	1.35E-11
Total by Pathway	2.36E-10	8.76E-12	9.45E-12	9.87E-12	8.39E-11	1.75E-12	1.93E-11	1.66E-11	NA	9.71E-10
Noncarcinogens (hazards)										
Acetaldehyde	7.03E-05	7.01E-11	1.11E-06	2.48E-14	4.92E-13	9.36E-13	2.77E-16	1.15E-13	NA	7.14E-05
Benzene	2.06E-14	3.21E-15	2.06E-12	1.14E-17	2.25E-16	4.37E-18	1.31E-19	5.42E-17	NA	2.08E-12
Ethylbenzene	8.63E-16	6.83E-16	3.98E-13	6.74E-18	1.29E-16	2.65E-18	8.21E-20	3.38E-17	NA	3.99E-13
Methyl Chloroform	1.58E-14	1.36E-11	1.87E-09	6.40E-14	1.26E-12	2.47E-14	7.47E-16	3.09E-13	NA	1.88E-09
Methylene Chloride	3.08E-13	1.05E-14	2.15E-11	1.57E-17	3.10E-16	5.93E-18	1.77E-19	7.29E-17	NA	2.18E-11
Tetrachloroethylene	4.32E-15	4.73E-15	1.36E-12	2.54E-17	4.96E-16	9.86E-18	2.98E-19	1.23E-16	NA	1.37E-12
Toluene	8.92E-15	3.80E-15	1.84E-12	2.32E-17	4.49E-16	8.93E-18	2.72E-19	1.12E-16	NA	1.85E-12
Vinyl Acetate	1.28E-14	1.89E-16	7.03E-13	1.64E-19	3.24E-18	6.19E-20	1.84E-21	7.58E-19	NA	7.16E-13
o-Xylene	9.45E-17	8.64E-17	4.37E-14	8.59E-19	1.64E-17	3.38E-19	1.05E-20	4.32E-18	NA	4.39E-14

Table 58b (continued)

	Ingestion of:									
Chemical	Surface Water	Soil	Vegetation	Beef	Milk	Pork	Poultry	Egg	Fish	Total
p-Xylene	2.15E-15	1.84E-20	5.49E-17	1.98E-20	3.47E-19	1.36E-21	2.34E-24	9.72E-22	NA	2.20E-15
2-Methylnaphthalene	1.32E-15	2.65E-14	8.79E-13	1.58E-16	2.91E-14	2.07E-16	2.71E-15	2.79E-15	NA	9.42E-13
Acenaphthene	4.37E-14	2.04E-14	2.30E-12	7.80E-16	1.39E-14	2.39E-16	7.33E-18	3.02E-15	NA	2.38E-12
Acenaphthylene	3.66E-15	1.50E-13	3.93E-12	1.15E-15	2.08E-13	1.57E-15	2.08E-14	2.14E-14	NA	4.34E-12
Anthracene	7.22E-16	1.05E-13	9.94E-13	5.07E-15	8.46E-14	2.38E-15	8.26E-17	3.41E-14	NA	1.23E-12
Benzo(g,h,i)perylene	2.43E-13	1.23E-11	7.56E-12	NC	NC	NC	NC	NC	NA	2.01E-11
Fluoranthene	9.86E-14	4.06E-12	1.88E-11	NC	NC	NC	NC	NC	NA	2.30E-11
Fluorene	9.69E-15	5.88E-16	8.85E-15	1.81E-16	3.17E-15	1.91E-17	2.86E-19	1.18E-16	NA	2.26E-14
Formaldehyde	7.86E-13	1.14E-15	7.35E-12	7.01E-19	1.39E-17	2.64E-19	7.84E-21	3.24E-18	NA	8.14E-12
Manganese	NC	1.86E-13	2.16E-10	NC	NC	NC	NC	NC	NA	2.16E-10
Naphthalene	4.82E-14	3.15E-13	5.51E-11	4.03E-15	7.61E-14	1.63E-15	5.11E-17	2.11E-14	NA	5.55E-11
Phenol	1.88E-10	1.52E-12	1.82E-09	2.82E-15	5.57E-14	1.07E-15	3.19E-17	1.31E-14	NA	2.01E-09
Pyrene	1.95E-13	2.28E-16	7.01E-14	1.76E-13	3.08E-12	1.15E-14	4.63E-19	1.91E-16	NA	3.53E-12
Arsenic	2.87E-06	1.81E-08	5.94E-08	1.34E-08	2.17E-08	NC	NC	NC	NA	2.99E-06
Beryllium	3.06E-09	3.82E-09	2.25E-09	2.58E-10	1.12E-11	NC	NC	NC	NA	9.40E-09
Cadmium	2.41E-08	8.61E-10	1.24E-08	4.78E-11	1.47E-10	1.18E-11	2.76E-10	6.71E-12	NA	3.78E-08
Chlorine	1.70E-03	1.49E-09	NC	2.28E-09	1.24E-08	NC	NC	NC	NA	1.70E-03
Chromium	2.82E-14	1.05E-10	7.34E-11	2.72E-11	3.34E-10	NC	NC	NC	NA	5.39E-10
Chromium VI	4.29E-07	1.22E-09	1.06E-08	7.24E-09	1.08E-07	NC	NC	NC	NA	5.56E-07
Nickel	1.81E-06	5.04E-08	1.73E-07	1.07E-07	9.62E-07	NC	NC	NC	NA	3.11E-06
Selenium	2.64E-07	6.03E-11	1.00E-09	2.60E-10	3.68E-08	8.68E-10	5.47E-11	5.64E-11	NA	3.03E-07

NC - Not Calculated NA - Not Applicable

Table 58c Estimates of Risk and Hazard by the Subsistence Fisher for the ARFF Scenario

	Ingestion of:								
Chemical	Surface Water	Soil	Vegetation	Beef	Milk	Pork	Poultry	Egg	Fish	Total
Carcinogens (risks)										
Acetaldehyde	2.70E-10	6.45E-17	1.58E-12	NA	NA	NA	NA	NA	6.32E-12	2.78E-10
Benzene	1.95E-18	7.26E-20	7.24E-17	NA	NA	NA	NA	NA	2.83E-18	7.73E-17
Methylene Chloride	2.66E-17	2.17E-19	6.90E-16	NA	NA	NA	NA	NA	8.25E-18	7.25E-16
Tetrachloroethylene	4.31E-19	1.13E-19	5.13E-17	NA	NA	NA	NA	NA	1.28E-18	5.31E-17
Benzo[a]anthracene	2.55E-15	1.75E-14	6.39E-14	NA	NA	NA	NA	NA	7.61E-13	8.45E-13
Benzo[b]flouranthene	1.28E-15	1.70E-14	3.55E-14	NA	NA	NA	NA	NA	7.44E-13	7.98E-13
Chrysene	4.11E-17	1.50E-16	5.25E-16	NA	NA	NA	NA	NA	1.45E-14	1.52E-14
Dibenz[a,h]anthracene	5.65E-16	6.10E-15	8.86E-14	NA	NA	NA	NA	NA	4.23E-13	5.18E-13
Formaldehyde	1.36E-15	4.72E-19	4.74E-15	NA	NA	NA	NA	NA	2.66E-17	6.12E-15
Indeno[1,2,3-cd]pyrene	5.76E-17	1.41E-15	8.30E-14	NA	NA	NA	NA	NA	4.41E-14	1.29E-13
2,3,7,8-TCDDioxin Toxicity Equivalents	2.94E-14	1.33E-12	1.50E-12	NA	NA	NA	NA	NA	6.73E-14	2.92E-12
Arsenic	2.48E-10	3.74E-13	2.05E-12	NA	NA	NA	NA	NA	2.90E-10	5.41E-10
Beryllium	9.87E-12	2.95E-12	2.91E-12	NA	NA	NA	NA	NA	2.42E-11	4.00E-11
Total by Pathway	5.28E-10	4.69E-12	8.31E-12	NA	NA	NA	NA	NA	3.23E-10	8.64E-10
Noncarcinogens (hazards)										
Acetaldehyde	3.15E-05	7.52E-12	1.84E-07	NA	NA	NA	NA	NA	7.37E-07	3.24E-05
Benzene	9.22E-15	3.44E-16	3.43E-13	NA	NA	NA	NA	NA	1.34E-14	3.66E-13
Ethylbenzene	3.87E-16	7.32E-17	6.42E-14	NA	NA	NA	NA	NA	3.14E-15	6.78E-14
Methyl Chloroform	7.09E-15	1.45E-12	3.41E-10	NA	NA	NA	NA	NA	1.69E-14	3.43E-10
Methylene Chloride	1.38E-13	1.12E-15	3.58E-12	NA	NA	NA	NA	NA	4.28E-14	3.76E-12
Tetrachloroethylene	1.94E-15	5.07E-16	2.30E-13	NA	NA	NA	NA	NA	5.73E-15	2.38E-13
Toluene	4.00E-15	4.07E-16	3.01E-13	NA	NA	NA	NA	NA	1.47E-14	3.20E-13
Vinyl Acetate	5.74E-15	2.02E-17	1.18E-13	NA	NA	NA	NA	NA	6.71E-16	1.24E-13
o-Xylene	4.23E-17	9.26E-18	7.06E-15	NA	NA	NA	NA	NA	3.49E-16	7.47E-15

Table 58c (continued)

Chemical	Ingestion of: Surface Water	Soil	Vegetation	Beef	Milk	Pork	Poultry	Egg	Fish	Total
p-Xylene	9.61E-16	1.98E-21	9.67E-18	NA	NA	NA	NA	NA	8.49E-15	9.46E-15
2-Methylnaphthalene	5.90E-16	2.84E-15	1.55E-13	NA	NA	NA	NA	NA	1.37E-14	1.72E-13
Acenaphthene	1.96E-14	2.18E-15	3.76E-13	NA	NA	NA	NA	NA	6.95E-13	1.09E-12
Acenaphthylene	1.64E-15	1.61E-14	6.90E-13	NA	NA	NA	NA	NA	5.58E-15	7.13E-13
Anthracene	3.23E-16	1.13E-14	1.81E-13	NA	NA	NA	NA	NA	4.92E-14	2.41E-13
Benzo(g,h,i)perylene	1.09E-13	1.32E-12	1.36E-12	NA	NA	NA	NA	NA	NC	2.79E-12
Fluoranthene	4.41E-14	4.35E-13	3.38E-12	NA	NA	NA	NA	NA	4.05E-11	4.44E-11
Fluorene	4.34E-15	6.30E-17	1.61E-15	NA	NA	NA	NA	NA	3.05E-13	3.11E-13
Formaldehyde	3.52E-13	1.22E-16	1.23E-12	NA	NA	NA	NA	NA	6.90E-15	1.59E-12
Manganese	NC	1.99E-14	3.86E-11	NA	NA	NA	NA	NA	NC	3.86E-11
Naphthalene	2.16E-14	3.38E-14	9.05E-12	NA	NA	NA	NA	NA	2.72E-13	9.38E-12
Phenol	8.40E-11	1.63E-13	3.07E-10	NA	NA	NA	NA	NA	3.84E-11	4.29E-10
Pyrene	8.72E-14	2.44E-17	1.25E-14	NA	NA	NA	NA	NA	6.07E-11	6.08E-11
Arsenic	1.29E-06	1.94E-09	1.06E-08	NA	NA	NA	NA	NA	1.51E-06	2.80E-06
Beryllium	1.37E-09	4.10E-10	4.04E-10	NA	NA	NA	NA	NA	3.37E-09	5.55E-09
Cadmium	1.08E-08	9.23E-11	2.23E-09	NA	NA	NA	NA	NA	1.58E-07	1.71E-07
Chlorine	7.61E-04	1.59E-10	NC	NA	NA	NA	NA	NA	NC	7.61E-04
Chromium	1.26E-14	1.12E-11	1.32E-11	NA	NA	NA	NA	NA	1.40E-13	2.46E-11
Chromium VI	1.92E-07	1.30E-10	1.89E-09	NA	NA	NA	NA	NA	3.37E-08	2.28E-07
Nickel	8.13E-07	5.39E-09	3.10E-08	NA	NA	NA	NA	NA	3.71E-06	4.56E-06
Selenium	1.18E-07	6.46E-12	1.79E-10	NA	NA	NA	NA	NA	8.92E-07	1.01E-06

NC - Not Calculated NA - Not Applicable

Table 58d Estimates of Risk and Hazard by the Subsistence Fisher Child for the ARFF Scenario

Chemical	Ingestion of: Surface Water	Soil	Vegetation	Beef	Milk	Pork	Poultry	Egg	Fish	Total
Carcinogens (risks)										
Acetaldehyde	1.21E-10	1.20E-16	4.76E-13	NA	NA	NA	NA	NA	8.20E-13	1.22E-10
Benzene	8.70E-19	1.36E-19	2.17E-17	NA	NA	NA	NA	NA	3.67E-19	2.31E-17
Methylene Chloride	1.19E-17	4.05E-19	2.07E-16	NA	NA	NA	NA	NA	1.07E-18	2.20E-16
Tetrachloroethylene	1.93E-19	2.11E-19	1.52E-17	NA	NA	NA	NA	NA	1.66E-19	1.58E-17
Benzo[a]anthracene	1.14E-15	3.26E-14	1.79E-14	NA	NA	NA	NA	NA	9.88E-14	1.50E-13
Benzo[b]flouranthene	5.71E-16	3.18E-14	1.00E-14	NA	NA	NA	NA	NA	9.66E-14	1.39E-13
Chrysene	1.83E-17	2.80E-16	1.47E-16	NA	NA	NA	NA	NA	1.88E-15	2.33E-15
Dibenz[a,h]anthracene	2.52E-16	1.14E-14	2.49E-14	NA	NA	NA	NA	NA	5.49E-14	9.14E-14
Formaldehyde	6.07E-16	8.81E-19	1.42E-15	NA	NA	NA	NA	NA	3.45E-18	2.03E-15
Indeno[1,2,3-cd]pyrene	2.57E-17	2.63E-15	2.32E-14	NA	NA	NA	NA	NA	5.73E-15	3.16E-14
2,3,7,8-TCDDioxin Toxicity Equivalents	1.31E-14	2.48E-12	4.26E-13	NA	NA	NA	NA	NA	8.73E-15	2.92E-12
Arsenic	1.11E-10	6.97E-13	5.73E-13	NA	NA	NA	NA	NA	3.77E-11	1.50E-10
Beryllium	4.41E-12	5.51E-12	8.09E-13	NA	NA	NA	NA	NA	3.15E-12	1.39E-11
Total by Pathway	2.36E-10	8.76E-12	2.36E-12	NA	NA	NA	NA	NA	4.19E-11	2.89E-10
Noncarcinogens (hazards)										
Acetaldehyde	7.03E-05	7.01E-11	2.77E-07	NA	NA	NA	NA	NA	4.78E-07	7.11E-05
Benzene	2.06E-14	3.21E-15	5.15E-13	NA	NA	NA	NA	NA	8.68E-15	5.47E-13
Ethylbenzene	8.63E-16	6.83E-16	9.94E-14	NA	NA	NA	NA	NA	2.04E-15	1.03E-13
Methyl Chloroform	1.58E-14	1.36E-11	4.67E-10	NA	NA	NA	NA	NA	1.10E-14	4.80E-10
Methylene Chloride	3.08E-13	1.05E-14	5.37E-12	NA	NA	NA	NA	NA	2.77E-14	5.71E-12
Tetrachloroethylene	4.32E-15	4.73E-15	3.41E-13	NA	NA	NA	NA	NA	3.72E-15	3.54E-13
Toluene	8.92E-15	3.80E-15	4.59E-13	NA	NA	NA	NA	NA	9.51E-15	4.81E-13
Vinyl Acetate	1.28E-14	1.89E-16	1.76E-13	NA	NA	NA	NA	NA	4.36E-16	1.89E-13
o-Xylene	9.45E-17	8.64E-17	1.09E-14	NA	NA	NA	NA	NA	2.26E-16	1.13E-14

Table 58d (continued)

Chemical	Ingestion of:									Total
	Surface Water	Soil	Vegetation	Beef	Milk	Pork	Poultry	Egg	Fish	
p-Xylene	2.15E-15	1.84E-20	1.37E-17	NA	NA	NA	NA	NA	5.51E-15	7.67E-15
2-Methylnaphthalene	1.32E-15	2.65E-14	2.20E-13	NA	NA	NA	NA	NA	8.86E-15	2.56E-13
Acenaphthene	4.37E-14	2.04E-14	5.75E-13	NA	NA	NA	NA	NA	4.51E-13	1.09E-12
Acenaphthylene	3.66E-15	1.50E-13	9.83E-13	NA	NA	NA	NA	NA	3.62E-15	1.14E-12
Anthracene	7.22E-16	1.05E-13	2.49E-13	NA	NA	NA	NA	NA	3.19E-14	3.86E-13
Benzo(g,h,i)perylene	2.43E-13	1.23E-11	1.89E-12	NA	NA	NA	NA	NA	NC	1.44E-11
Fluoranthene	9.86E-14	4.06E-12	4.70E-12	NA	NA	NA	NA	NA	2.63E-11	3.52E-11
Fluorene	9.69E-15	5.88E-16	2.21E-15	NA	NA	NA	NA	NA	1.98E-13	2.10E-13
Formaldehyde	7.86E-13	1.14E-15	1.84E-12	NA	NA	NA	NA	NA	4.48E-15	2.63E-12
Manganese	NC	1.86E-13	5.40E-11	NA	NA	NA	NA	NA	NC	5.42E-11
Naphthalene	4.82E-14	3.15E-13	1.38E-11	NA	NA	NA	NA	NA	1.76E-13	1.43E-11
Phenol	1.88E-10	1.52E-12	4.54E-10	NA	NA	NA	NA	NA	2.49E-11	6.69E-10
Pyrene	1.95E-13	2.28E-16	1.75E-14	NA	NA	NA	NA	NA	3.94E-11	3.96E-11
Arsenic	2.87E-06	1.81E-08	1.49E-08	NA	NA	NA	NA	NA	9.77E-07	3.88E-06
Beryllium	3.06E-09	3.82E-09	5.62E-10	NA	NA	NA	NA	NA	2.18E-09	9.63E-09
Cadmium	2.41E-08	8.61E-10	3.10E-09	NA	NA	NA	NA	NA	1.02E-07	1.30E-07
Chlorine	1.70E-03	1.49E-09	NC	NA	NA	NA	NA	NA	NC	1.70E-03
Chromium	2.82E-14	1.05E-10	1.84E-11	NA	NA	NA	NA	NA	9.11E-14	1.23E-10
Chromium VI	4.29E-07	1.22E-09	2.65E-09	NA	NA	NA	NA	NA	2.19E-08	4.55E-07
Nickel	1.81E-06	5.04E-08	4.33E-08	NA	NA	NA	NA	NA	2.41E-06	4.31E-06
Selenium	2.64E-07	6.03E-11	2.50E-10	NA	NA	NA	NA	NA	5.79E-07	8.43E-07

NC - Not Calculated NA - Not Applicable

Table 58e Estimates of Risk and Hazard by the Adult Resident for the ARFF Scenario

	Ingestion of:									
Chemical	Surface Water	Soil	Vegetation	Beef	Milk	Pork	Poultry	Egg	Fish	Total
Carcinogens (risks)										
Acetaldehyde	2.70E-10	6.45E-17	1.58E-12	NA	NA	NA	NA	NA	NA	2.72E-10
Benzene	1.95E-18	7.26E-20	7.24E-17	NA	NA	NA	NA	NA	NA	7.44E-17
Methylene Chloride	2.66E-17	2.17E-19	6.90E-16	NA	NA	NA	NA	NA	NA	7.17E-16
Tetrachloroethylene	4.31E-19	1.13E-19	5.13E-17	NA	NA	NA	NA	NA	NA	5.18E-17
Benzo[a]anthracene	2.55E-15	1.75E-14	6.39E-14	NA	NA	NA	NA	NA	NA	8.39E-14
Benzo[b]flouranthene	1.28E-15	1.70E-14	3.55E-14	NA	NA	NA	NA	NA	NA	5.38E-14
Chrysene	4.11E-17	1.50E-16	5.25E-16	NA	NA	NA	NA	NA	NA	7.16E-16
Dibenz[a,h]anthracene	5.65E-16	6.10E-15	8.86E-14	NA	NA	NA	NA	NA	NA	9.53E-14
Formaldehyde	1.36E-15	4.72E-19	4.74E-15	NA	NA	NA	NA	NA	NA	6.10E-15
Indeno[1,2,3-cd]pyrene	5.76E-17	1.41E-15	8.30E-14	NA	NA	NA	NA	NA	NA	8.45E-14
2,3,7,8-TCDDioxin Toxicity Equivalents	2.94E-14	1.33E-12	1.50E-12	NA	NA	NA	NA	NA	NA	2.86E-12
Arsenic	2.48E-10	3.74E-13	2.05E-12	NA	NA	NA	NA	NA	NA	2.51E-10
Beryllium	9.87E-12	2.95E-12	2.91E-12	NA	NA	NA	NA	NA	NA	1.57E-11
Total by Pathway	5.28E-10	4.69E-12	8.31E-12	NA	NA	NA	NA	NA	NA	5.41E-10
Noncarcinogens (hazards)										
Acetaldehyde	3.15E-05	7.52E-12	1.84E-07	NA	NA	NA	NA	NA	NA	3.17E-05
Benzene	9.22E-15	3.44E-16	3.43E-13	NA	NA	NA	NA	NA	NA	3.52E-13
Ethylbenzene	3.87E-16	7.32E-17	6.42E-14	NA	NA	NA	NA	NA	NA	6.46E-14
Methyl Chloroform	7.09E-15	1.45E-12	3.41E-10	NA	NA	NA	NA	NA	NA	3.43E-10
Methylene Chloride	1.38E-13	1.12E-15	3.58E-12	NA	NA	NA	NA	NA	NA	3.72E-12
Tetrachloroethylene	1.94E-15	5.07E-16	2.30E-13	NA	NA	NA	NA	NA	NA	2.33E-13
Toluene	4.00E-15	4.07E-16	3.01E-13	NA	NA	NA	NA	NA	NA	3.05E-13
Vinyl Acetate	5.74E-15	2.02E-17	1.18E-13	NA	NA	NA	NA	NA	NA	1.24E-13
o-Xylene	4.23E-17	9.26E-18	7.06E-15	NA	NA	NA	NA	NA	NA	7.12E-15

Table 58e (continued)

Chemical	Ingestion of: Surface Water	Soil	Vegetation	Beef	Milk	Pork	Poultry	Egg	Fish	Total
p-Xylene	9.61E-16	1.98E-21	9.67E-18	NA	NA	NA	NA	NA	NA	9.71E-16
2-Methylnaphthalene	5.90E-16	2.84E-15	1.55E-13	NA	NA	NA	NA	NA	NA	1.59E-13
Acenaphthene	1.96E-14	2.18E-15	3.76E-13	NA	NA	NA	NA	NA	NA	3.98E-13
Acenaphthylene	1.64E-15	1.61E-14	6.90E-13	NA	NA	NA	NA	NA	NA	7.08E-13
Anthracene	3.23E-16	1.13E-14	1.81E-13	NA	NA	NA	NA	NA	NA	1.92E-13
Benzo(g,h,i)perylene	1.09E-13	1.32E-12	1.36E-12	NA	NA	NA	NA	NA	NA	2.79E-12
Fluoranthene	4.41E-14	4.35E-13	3.38E-12	NA	NA	NA	NA	NA	NA	3.86E-12
Fluorene	4.34E-15	6.30E-17	1.61E-15	NA	NA	NA	NA	NA	NA	6.01E-15
Formaldehyde	3.52E-13	1.22E-16	1.23E-12	NA	NA	NA	NA	NA	NA	1.58E-12
Manganese	NC	1.99E-14	3.86E-11	NA	NA	NA	NA	NA	NA	3.86E-11
Naphthalene	2.16E-14	3.38E-14	9.05E-12	NA	NA	NA	NA	NA	NA	9.11E-12
Phenol	8.40E-11	1.63E-13	3.07E-10	NA	NA	NA	NA	NA	NA	3.91E-10
Pyrene	8.72E-14	2.44E-17	1.25E-14	NA	NA	NA	NA	NA	NA	9.98E-14
Arsenic	1.29E-06	1.94E-09	1.06E-08	NA	NA	NA	NA	NA	NA	1.30E-06
Beryllium	1.37E-09	4.10E-10	4.04E-10	NA	NA	NA	NA	NA	NA	2.18E-09
Cadmium	1.08E-08	9.23E-11	2.23E-09	NA	NA	NA	NA	NA	NA	1.31E-08
Chlorine	7.61E-04	1.59E-10	NC	NA	NA	NA	NA	NA	NA	7.61E-04
Chromium	1.26E-14	1.12E-11	1.32E-11	NA	NA	NA	NA	NA	NA	2.44E-11
Chromium VI	1.92E-07	1.30E-10	1.89E-09	NA	NA	NA	NA	NA	NA	1.94E-07
Nickel	8.13E-07	5.39E-09	3.10E-08	NA	NA	NA	NA	NA	NA	8.49E-07
Selenium	1.18E-07	6.46E-12	1.79E-10	NA	NA	NA	NA	NA	NA	1.18E-07

NC - Not Calculated NA - Not Applicable

Table 58f Estimates of Risk and Hazard by the Child Resident for the ARFF Scenario

Chemical	Ingestion of: Surface Water	Soil	Vegetation	Beef	Milk	Pork	Poultry	Egg	Fish	Total
Carcinogens (risks)										
Acetaldehyde	1.21E-10	1.20E-16	4.76E-13	NA	NA	NA	NA	NA	NA	1.21E-10
Benzene	8.70E-19	1.36E-19	2.17E-17	NA	NA	NA	NA	NA	NA	2.28E-17
Methylene Chloride	1.19E-17	4.05E-19	2.07E-16	NA	NA	NA	NA	NA	NA	2.19E-16
Tetrachloroethylene	1.93E-19	2.11E-19	1.52E-17	NA	NA	NA	NA	NA	NA	1.56E-17
Benzo[a]anthracene	1.14E-15	3.26E-14	1.79E-14	NA	NA	NA	NA	NA	NA	5.16E-14
Benzo[b]flouranthene	5.71E-16	3.18E-14	1.00E-14	NA	NA	NA	NA	NA	NA	4.24E-14
Chrysene	1.83E-17	2.80E-16	1.47E-16	NA	NA	NA	NA	NA	NA	4.45E-16
Dibenz[a,h]anthracene	2.52E-16	1.14E-14	2.49E-14	NA	NA	NA	NA	NA	NA	3.65E-14
Formaldehyde	6.07E-16	8.81E-19	1.42E-15	NA	NA	NA	NA	NA	NA	2.02E-15
Indeno[1,2,3-cd]pyrene	2.57E-17	2.63E-15	2.32E-14	NA	NA	NA	NA	NA	NA	2.59E-14
2,3,7,8-TCDDioxin Toxicity Equivalents	1.31E-14	2.48E-12	4.26E-13	NA	NA	NA	NA	NA	NA	2.91E-12
Arsenic	1.11E-10	6.97E-13	5.73E-13	NA	NA	NA	NA	NA	NA	1.12E-10
Beryllium	4.41E-12	5.51E-12	8.09E-13	NA	NA	NA	NA	NA	NA	1.07E-11
Total by Pathway	2.36E-10	8.76E-12	2.36E-12	NA	NA	NA	NA	NA	NA	2.47E-10
Noncarcinogens (hazards)										
Acetaldehyde	7.03E-05	7.01E-11	2.77E-07	NA	NA	NA	NA	NA	NA	7.06E-05
Benzene	2.06E-14	3.21E-15	5.15E-13	NA	NA	NA	NA	NA	NA	5.38E-13
Ethylbenzene	8.63E-16	6.83E-16	9.94E-14	NA	NA	NA	NA	NA	NA	1.01E-13
Methyl Chloroform	1.58E-14	1.36E-11	4.67E-10	NA	NA	NA	NA	NA	NA	4.80E-10
Methylene Chloride	3.08E-13	1.05E-14	5.37E-12	NA	NA	NA	NA	NA	NA	5.69E-12
Tetrachloroethylene	4.32E-15	4.73E-15	3.41E-13	NA	NA	NA	NA	NA	NA	3.50E-13
Toluene	8.92E-15	3.80E-15	4.59E-13	NA	NA	NA	NA	NA	NA	4.72E-13
Vinyl Acetate	1.28E-14	1.89E-16	1.76E-13	NA	NA	NA	NA	NA	NA	1.89E-13
o-Xylene	9.45E-17	8.64E-17	1.09E-14	NA	NA	NA	NA	NA	NA	1.11E-14

Table 58f (continued)

	Ingestion of:									
Chemical	Surface Water	Soil	Vegetation	Beef	Milk	Pork	Poultry	Egg	Fish	Total
p-Xylene	2.15E-15	1.84E-20	1.37E-17	NA	NA	NA	NA	NA	NA	2.16E-15
2-Methylnaphthalene	1.32E-15	2.65E-14	2.20E-13	NA	NA	NA	NA	NA	NA	2.48E-13
Acenaphthene	4.37E-14	2.04E-14	5.75E-13	NA	NA	NA	NA	NA	NA	6.39E-13
Acenaphthylene	3.66E-15	1.50E-13	9.83E-13	NA	NA	NA	NA	NA	NA	1.14E-12
Anthracene	7.22E-16	1.05E-13	2.49E-13	NA	NA	NA	NA	NA	NA	3.54E-13
Benzo(g,h,i)perylene	2.43E-13	1.23E-11	1.89E-12	NA	NA	NA	NA	NA	NA	1.44E-11
Fluoranthene	9.86E-14	4.06E-12	4.70E-12	NA	NA	NA	NA	NA	NA	8.87E-12
Fluorene	9.69E-15	5.88E-16	2.21E-15	NA	NA	NA	NA	NA	NA	1.25E-14
Formaldehyde	7.86E-13	1.14E-15	1.84E-12	NA	NA	NA	NA	NA	NA	2.62E-12
Manganese	NC	1.86E-13	5.40E-11	NA	NA	NA	NA	NA	NA	5.42E-11
Naphthalene	4.82E-14	3.15E-13	1.38E-11	NA	NA	NA	NA	NA	NA	1.41E-11
Phenol	1.88E-10	1.52E-12	4.54E-10	NA	NA	NA	NA	NA	NA	6.44E-10
Pyrene	1.95E-13	2.28E-16	1.75E-14	NA	NA	NA	NA	NA	NA	2.13E-13
Arsenic	2.87E-06	1.81E-08	1.49E-08	NA	NA	NA	NA	NA	NA	2.91E-06
Beryllium	3.06E-09	3.82E-09	5.62E-10	NA	NA	NA	NA	NA	NA	7.45E-09
Cadmium	2.41E-08	8.61E-10	3.10E-09	NA	NA	NA	NA	NA	NA	2.80E-08
Chlorine	1.70E-03	1.49E-09	NC	NA	NA	NA	NA	NA	NA	1.70E-03
Chromium	2.82E-14	1.05E-10	1.84E-11	NA	NA	NA	NA	NA	NA	1.23E-10
Chromium VI	4.29E-07	1.22E-09	2.65E-09	NA	NA	NA	NA	NA	NA	4.33E-07
Nickel	1.81E-06	5.04E-08	4.33E-08	NA	NA	NA	NA	NA	NA	1.91E-06
Selenium	2.64E-07	6.03E-11	2.50E-10	NA	NA	NA	NA	NA	NA	2.64E-07

NC - Not Calculated NA - Not Applicable

Table 59a Estimates of Risk and Hazard by the Subsistence Farmer for the Propane Scenario

Chemical	Ingestion of: Surface Water	Soil	Vegetation	Beef	Milk	Pork	Poultry	Egg	Fish	Total
Carcinogens (risks)										
Benzene	3.72E-17	5.57E-19	2.22E-15	4.14E-20	1.65E-19	9.44E-21	3.05E-22	1.24E-19	NA	2.26E-15
Formaldehyde	2.40E-14	3.50E-18	1.41E-13	4.48E-20	1.80E-19	1.01E-20	3.22E-22	1.31E-19	NA	1.65E-13
Arsenic	1.53E-12	1.18E-15	6.08E-14	4.65E-14	1.55E-14	NC	NC	NC	NA	1.65E-12
Total by Pathway	1.55E-12	1.19E-15	2.04E-13	4.65E-14	1.55E-14	1.95E-20	6.27E-22	2.56E-19	NA	1.82E-12
Noncarcinogens (hazards)										
Benzene	1.32E-13	1.98E-15	7.89E-12	1.47E-16	5.87E-16	3.35E-17	1.08E-18	4.41E-16	NA	8.02E-12
Toluene	7.31E-14	2.98E-15	8.83E-12	3.80E-16	1.50E-15	8.72E-17	2.86E-18	1.16E-15	NA	8.90E-12
2-Methylnaphthalene	1.30E-14	2.50E-14	5.47E-12	3.10E-15	1.16E-13	2.43E-15	3.42E-14	3.48E-14	NA	5.69E-12
Fluoranthene	1.07E-13	4.89E-13	1.52E-11	1.48E-12	4.56E-12	3.98E-13	1.56E-14	6.33E-12	NA	2.86E-11
Fluorene	8.99E-15	5.17E-17	5.33E-15	4.67E-16	1.66E-15	2.62E-17	3.36E-19	1.37E-16	NA	1.67E-14
Formaldehyde	4.67E-12	6.80E-16	2.73E-11	8.71E-18	3.51E-17	1.96E-18	6.26E-20	2.55E-17	NA	3.20E-11
Naphthalene	6.13E-13	3.82E-13	4.10E-10	1.02E-13	3.91E-13	2.45E-14	8.31E-16	3.38E-13	NA	4.12E-10
Pyrene	1.72E-13	1.90E-17	4.98E-14	4.45E-13	1.58E-12	1.75E-14	5.16E-19	2.10E-16	NA	2.26E-12
Arsenic	5.94E-09	4.60E-12	2.36E-10	1.81E-10	6.01E-11	NC	NC	NC	NA	6.42E-09
Nickel	2.32E-09	8.01E-12	2.64E-10	5.50E-10	1.01E-09	NC	NC	NC	NA	4.15E-09

NC - Not Calculated NA - Not Applicable

Table 59b Estimates of Risk and Hazard by the Subsistence Farmer Child for the Propane Scenario

	Ingestion of:									
Chemical	Surface Water	Soil	Vegetation	Beef	Milk	Pork	Poultry	Egg	Fish	Total
Carcinogens (risks)										
Benzene	1.25E-17	1.04E-18	6.67E-16	3.70E-21	7.29E-20	1.42E-21	4.25E-23	1.76E-20	NA	6.81E-16
Formaldehyde	8.04E-15	6.53E-18	4.20E-14	4.01E-21	7.96E-20	1.51E-21	4.48E-23	1.86E-20	NA	5.01E-14
Arsenic	6.35E-13	2.17E-15	1.31E-14	3.16E-15	5.16E-15	NC	NC	NC	NA	6.59E-13
Total by Pathway	6.43E-13	2.18E-15	5.58E-14	3.16E-15	5.16E-15	2.93E-21	8.74E-23	3.61E-20	NA	7.10E-13
Noncarcinogens (hazards)										
Benzene	2.95E-13	2.46E-14	1.58E-11	8.75E-17	1.72E-15	3.35E-17	1.01E-18	4.16E-16	NA	1.61E-11
Toluene	1.63E-13	3.71E-14	1.79E-11	2.26E-16	4.39E-15	8.73E-17	2.66E-18	1.10E-15	NA	1.81E-11
2-Methylnaphthalene	2.91E-14	3.11E-13	1.03E-11	1.85E-15	3.41E-13	2.44E-15	3.18E-14	3.28E-14	NA	1.11E-11
Fluoranthene	2.63E-13	5.83E-12	2.70E-11	8.15E-13	1.23E-11	3.80E-13	1.39E-14	5.72E-12	NA	5.23E-11
Fluorene	2.01E-14	6.43E-16	9.66E-15	2.14E-16	3.74E-15	2.20E-17	3.13E-19	1.29E-16	NA	3.45E-14
Formaldehyde	1.04E-11	8.46E-15	5.45E-11	5.19E-18	1.03E-16	1.96E-18	5.81E-20	2.40E-17	NA	6.49E-11
Naphthalene	1.37E-12	4.76E-12	8.31E-10	6.08E-14	1.15E-12	2.46E-14	7.72E-16	3.19E-13	NA	8.39E-10
Pyrene	3.83E-13	2.36E-16	7.00E-14	1.99E-13	3.48E-12	1.31E-14	4.79E-19	1.98E-16	NA	4.15E-12
Arsenic	1.65E-08	5.62E-11	3.40E-10	8.18E-11	1.34E-10	NC	NC	NC	NA	1.71E-08
Nickel	6.35E-09	9.57E-11	3.90E-10	2.50E-10	2.26E-09	NC	NC	NC	NA	9.35E-09

NC - Not Calculated   NA - Not Applicable

Table 59c Estimates of Risk and Hazard by the Subsistence Fisher for the Propane Scenario

Chemical	Ingestion of: Surface Water	Soil	Vegetation	Beef	Milk	Pork	Poultry	Egg	Fish	Total
Carcinogens (risks)										
Benzene	2.79E-17	5.57E-19	5.55E-16	NA	NA	NA	NA	NA	4.04E-17	6.24E-16
Formaldehyde	1.80E-14	3.50E-18	3.51E-14	NA	NA	NA	NA	NA	3.53E-16	5.35E-14
Arsenic	1.42E-12	1.16E-15	1.17E-14	NA	NA	NA	NA	NA	1.66E-12	3.10E-12
Total by Pathway	1.44E-12	1.17E-15	4.74E-14	NA	NA	NA	NA	NA	1.66E-12	3.15E-12
Noncarcinogens (hazards)										
Benzene	1.32E-13	2.64E-15	2.63E-12	NA	NA	NA	NA	NA	1.91E-13	2.95E-12
Toluene	7.31E-14	3.97E-15	2.94E-12	NA	NA	NA	NA	NA	2.68E-13	3.29E-12
2-Methylnaphthalene	1.30E-14	3.34E-14	1.82E-12	NA	NA	NA	NA	NA	3.02E-13	2.17E-12
Fluoranthene	1.18E-13	6.25E-13	4.85E-12	NA	NA	NA	NA	NA	1.08E-10	1.14E-10
Fluorene	8.99E-15	6.89E-17	1.75E-15	NA	NA	NA	NA	NA	6.31E-13	6.42E-13
Formaldehyde	4.67E-12	9.07E-16	9.11E-12	NA	NA	NA	NA	NA	9.15E-14	1.39E-11
Naphthalene	6.15E-13	5.10E-13	1.37E-10	NA	NA	NA	NA	NA	7.74E-12	1.45E-10
Pyrene	1.72E-13	2.53E-17	1.25E-14	NA	NA	NA	NA	NA	1.19E-10	1.20E-10
Arsenic	7.37E-09	6.03E-12	6.07E-11	NA	NA	NA	NA	NA	8.63E-09	1.61E-08
Nickel	2.84E-09	1.03E-11	6.97E-11	NA	NA	NA	NA	NA	1.30E-08	1.59E-08

NA - Not Applicable

Table 59d Estimates of Risk and Hazard by the Subsistence Fisher Child for the Propane Scenario

Chemical	Ingestion of: Surface Water	Soil	Vegetation	Beef	Milk	Pork	Poultry	Egg	Fish	Total
Carcinogens (risks)										
Benzene	1.25E-17	1.04E-18	1.67E-16	NA	NA	NA	NA	NA	5.25E-18	1.85E-16
Formaldehyde	8.04E-15	6.53E-18	1.05E-14	NA	NA	NA	NA	NA	4.58E-17	1.86E-14
Arsenic	6.35E-13	2.17E-15	3.28E-15	NA	NA	NA	NA	NA	2.16E-13	8.57E-13
Total by Pathway	6.43E-13	2.18E-15	1.40E-14	NA	NA	NA	NA	NA	2.16E-13	8.75E-13
Noncarcinogens (hazards)										
Benzene	2.95E-13	2.46E-14	3.95E-12	NA	NA	NA	NA	NA	1.24E-13	4.39E-12
Toluene	1.63E-13	3.71E-14	4.49E-12	NA	NA	NA	NA	NA	1.74E-13	4.86E-12
2-Methylnaphthalene	2.91E-14	3.11E-13	2.58E-12	NA	NA	NA	NA	NA	1.96E-13	3.12E-12
Fluoranthene	2.63E-13	5.83E-12	6.75E-12	NA	NA	NA	NA	NA	7.01E-11	8.30E-11
Fluorene	2.01E-14	6.43E-16	2.41E-15	NA	NA	NA	NA	NA	4.09E-13	4.32E-13
Formaldehyde	1.04E-11	8.46E-15	1.36E-11	NA	NA	NA	NA	NA	5.94E-14	2.41E-11
Naphthalene	1.37E-12	4.76E-12	2.08E-10	NA	NA	NA	NA	NA	5.02E-12	2.19E-10
Pyrene	3.83E-13	2.36E-16	1.75E-14	NA	NA	NA	NA	NA	7.75E-11	7.79E-11
Arsenic	1.65E-08	5.62E-11	8.50E-11	NA	NA	NA	NA	NA	5.60E-09	2.22E-08
Nickel	6.35E-09	9.57E-11	9.74E-11	NA	NA	NA	NA	NA	8.42E-09	1.50E-08

NA - Not Applicable

Table 59e Estimates of Risk and Hazard by the Adult Resident for the Propane Scenario

Chemical	Ingestion of: Surface Water	Soil	Vegetation	Beef	Milk	Pork	Poultry	Egg	Fish	Total
Carcinogens (risks)										
Benzene	2.79E-17	5.57E-19	5.55E-16	NA	NA	NA	NA	NA	NA	5.84E-16
Formaldehyde	1.80E-14	3.50E-18	3.51E-14	NA	NA	NA	NA	NA	NA	5.31E-14
Arsenic	1.42E-12	1.16E-15	1.17E-14	NA	NA	NA	NA	NA	NA	1.44E-12
Total by Pathway	1.44E-12	1.17E-15	4.74E-14	NA	NA	NA	NA	NA	NA	1.49E-12
Noncarcinogens (hazards)										
Benzene	1.32E-13	2.64E-15	2.63E-12	NA	NA	NA	NA	NA	NA	2.76E-12
Toluene	7.31E-14	3.97E-15	2.94E-12	NA	NA	NA	NA	NA	NA	3.02E-12
2-Methylnaphthalene	1.30E-14	3.34E-14	1.82E-12	NA	NA	NA	NA	NA	NA	1.87E-12
Fluoranthene	1.18E-13	6.25E-13	4.85E-12	NA	NA	NA	NA	NA	NA	5.59E-12
Fluorene	8.99E-15	6.89E-17	1.75E-15	NA	NA	NA	NA	NA	NA	1.08E-14
Formaldehyde	4.67E-12	9.07E-16	9.11E-12	NA	NA	NA	NA	NA	NA	1.38E-11
Naphthalene	6.15E-13	5.10E-13	1.37E-10	NA	NA	NA	NA	NA	NA	1.38E-10
Pyrene	1.72E-13	2.53E-17	1.25E-14	NA	NA	NA	NA	NA	NA	1.84E-13
Arsenic	7.37E-09	6.03E-12	6.07E-11	NA	NA	NA	NA	NA	NA	7.44E-09
Nickel	2.84E-09	1.03E-11	6.97E-11	NA	NA	NA	NA	NA	NA	2.92E-09

NA - Not Applicable

Table 59f Estimates of Risk and Hazard by the Child Resident for the Propane Scenario

Chemical	Ingestion of: Surface Water	Soil	Vegetation	Beef	Milk	Pork	Poultry	Egg	Fish	Total
Carcinogens (risks)										
Benzene	1.25E-17	1.04E-18	1.67E-16	NA	NA	NA	NA	NA	NA	1.80E-16
Formaldehyde	8.04E-15	6.53E-18	1.05E-14	NA	NA	NA	NA	NA	NA	1.86E-14
Arsenic	6.35E-13	2.17E-15	3.28E-15	NA	NA	NA	NA	NA	NA	6.41E-13
Total by Pathway	6.43E-13	2.18E-15	1.40E-14	NA	NA	NA	NA	NA	NA	6.59E-13
Noncarcinogens (hazards)										
Benzene	2.95E-13	2.46E-14	3.95E-12	NA	NA	NA	NA	NA	NA	4.27E-12
Toluene	1.63E-13	3.71E-14	4.49E-12	NA	NA	NA	NA	NA	NA	4.69E-12
2-Methylnaphthalene	2.91E-14	3.11E-13	2.58E-12	NA	NA	NA	NA	NA	NA	2.92E-12
Fluoranthene	2.63E-13	5.83E-12	6.75E-12	NA	NA	NA	NA	NA	NA	1.28E-11
Fluorene	2.01E-14	6.43E-16	2.41E-15	NA	NA	NA	NA	NA	NA	2.31E-14
Formaldehyde	1.04E-11	8.46E-15	1.36E-11	NA	NA	NA	NA	NA	NA	2.41E-11
Naphthalene	1.37E-12	4.76E-12	2.08E-10	NA	NA	NA	NA	NA	NA	2.14E-10
Pyrene	3.83E-13	2.36E-16	1.75E-14	NA	NA	NA	NA	NA	NA	4.01E-13
Arsenic	1.65E-08	5.62E-11	8.50E-11	NA	NA	NA	NA	NA	NA	1.66E-08
Nickel	6.35E-09	9.57E-11	9.74E-11	NA	NA	NA	NA	NA	NA	6.55E-09

NA - Not Applicable

Table 60a Estimates of Risk and Hazard by the Subsistence Farmer for the Drill Tower Scenario

Chemical	Ingestion of: Surface Water	Soil	Vegetation	Beef	Milk	Pork	Poultry	Egg	Fish	Total
Carcinogens (risks)										
Benzene	2.09E-13	1.16E-14	4.64E-11	8.64E-16	3.45E-15	1.97E-16	6.38E-18	2.60E-15	NA	4.66E-11
Benzo(a)pyrene	1.13E-10	1.23E-09	2.00E-08	NC	NC	NC	NC	NC	NA	2.13E-08
Benzo[a]anthracene	1.32E-10	1.66E-09	2.48E-08	NC	NC	NC	NC	NC	NA	2.66E-08
Benzo[b]fluoranthene	2.58E-11	6.28E-10	5.56E-09	NC	NC	NC	NC	NC	NA	6.21E-09
Benzo[k]fluoranthene	1.59E-12	2.41E-11	2.78E-10	NC	NC	NC	NC	NC	NA	3.04E-10
Chrysene	2.73E-12	1.92E-11	2.78E-10	NC	NC	NC	NC	NC	NA	3.00E-10
Dibenz[a,h]anthracene	3.69E-11	1.65E-09	3.59E-08	NC	NC	NC	NC	NC	NA	3.76E-08
Indeno[1,2,3-cd]pyrene	2.53E-12	2.53E-10	1.15E-08	NC	NC	NC	NC	NC	NA	1.18E-08
Arsenic	3.14E-10	1.83E-12	1.37E-10	1.07E-10	3.55E-11	NC	NC	NC	NA	5.95E-10
Chromium VI	7.92E-08	2.07E-10	2.31E-08	5.05E-08	1.53E-07	NC	NC	NC	NA	3.06E-07
Total by Pathway	7.99E-08	5.67E-09	1.22E-07	5.06E-08	1.53E-07	1.97E-16	6.38E-18	2.60E-15	NA	4.11E-07
Noncarcinogens (hazards)										
Benzaldehyde	1.50E-09	4.06E-11	3.22E-07	1.57E-12	6.30E-12	3.55E-13	1.14E-14	4.64E-12	NA	3.24E-07
Benzene	7.42E-10	4.13E-11	1.65E-07	3.07E-12	1.23E-11	7.00E-13	2.26E-14	9.22E-12	NA	1.66E-07
Methyl Ethyl Ketone	1.67E-10	2.98E-13	1.32E-08	3.59E-15	1.44E-14	8.07E-16	2.58E-17	1.05E-14	NA	1.34E-08
Styrene	2.39E-11	2.97E-11	2.96E-08	4.92E-12	1.93E-11	1.15E-12	3.81E-14	1.55E-11	NA	2.96E-08
Toluene	2.06E-11	3.13E-12	9.26E-09	3.99E-13	1.57E-12	9.15E-14	3.00E-15	1.22E-12	NA	9.28E-09
o-Xylene	8.52E-13	2.77E-13	8.45E-10	5.77E-14	2.24E-13	1.35E-14	4.50E-16	1.83E-13	NA	8.46E-10
2-Methylnaphthalene	1.06E-11	7.63E-11	1.67E-08	9.46E-12	3.54E-10	7.42E-12	1.04E-10	1.06E-10	NA	1.73E-08
Acenaphthene	8.39E-11	1.38E-11	9.71E-09	NC	NC	NC	NC	NC	NA	9.81E-09
Acenaphthylene	7.44E-10	1.10E-08	1.90E-06	NC	NC	NC	NC	NC	NA	1.91E-06
Anthracene	1.67E-11	9.02E-10	5.79E-08	NC	NC	NC	NC	NC	NA	5.88E-08
Furans	1.34E-09	2.83E-11	1.25E-07	9.82E-13	3.94E-12	2.19E-13	2.84E-12	2.89E-12	NA	1.26E-07
Manganese	NC	1.38E-12	2.15E-08	NC	NC	NC	NC	NC	NA	2.15E-08
Naphthalene	4.36E-09	1.01E-08	1.08E-05	2.70E-09	1.03E-08	6.49E-10	2.20E-11	8.94E-09	NA	1.09E-05

Table 60a (continued)

Chemical	Ingestion of: Surface Water	Soil	Vegetation	Beef	Milk	Pork	Poultry	Egg	Fish	Total
Phenol	4.07E-08	1.36E-10	1.03E-06	5.28E-12	2.11E-11	1.19E-12	3.82E-14	1.55E-11	NA	1.07E-06
Pyrene	4.13E-09	1.70E-12	6.58E-09	4.13E-08	1.46E-07	1.59E-09	4.63E-14	1.89E-11	NA	2.00E-07
n-Hexane	1.05E-13	2.62E-14	2.27E-11	2.31E-14	8.39E-14	2.17E-15	2.07E-14	2.10E-14	NA	2.30E-11
Antimony	2.77E-05	3.67E-07	2.48E-05	7.57E-06	8.47E-06	NC	NC	NC	NA	6.90E-05
Arsenic	1.22E-06	7.12E-09	5.33E-07	4.15E-07	1.38E-07	NC	NC	NC	NA	2.31E-06
Barium	1.76E-05	1.96E-07	1.40E-05	6.54E-07	1.70E-05	NC	NC	NC	NA	4.95E-05
Cadmium	1.11E-05	3.71E-07	4.07E-05	6.66E-07	4.10E-07	7.05E-08	1.59E-06	3.81E-08	NA	5.49E-05
Chlorine	2.12E-02	9.20E-09	NC	2.94E-07	3.25E-07	NC	NC	NC	NA	2.12E-02
Chromium	1.14E-13	4.20E-10	2.07E-09	2.50E-09	6.37E-09	NC	NC	NC	NA	1.14E-08
Chromium VI	1.13E-06	2.95E-09	3.29E-07	7.18E-07	2.18E-06	NC	NC	NC	NA	4.35E-06
Nickel	4.28E-08	1.11E-09	4.25E-08	9.04E-08	1.66E-07	NC	NC	NC	NA	3.43E-07
Selenium	1.14E-06	2.39E-10	9.86E-08	8.78E-08	2.53E-06	1.53E-07	2.91E-09	2.95E-09	NA	4.01E-06
Silver	9.39E-06	5.09E-09	1.73E-06	1.58E-06	1.18E-04	NC	NC	NC	NA	1.31E-04
Zinc	4.65E-08	1.11E-09	9.03E-08	1.62E-09	6.58E-09	1.20E-10	2.98E-10	3.03E-10	NA	1.47E-07

NC - Not Calculated NA - Not Applicable

Table 60b Estimates of Risk and Hazard by the Subsistence Farmer Child for the Drill Tower Scenario

	Ingestion of:									
Chemical	Surface Water	Soil	Vegetation	Beef	Milk	Pork	Poultry	Egg	Fish	Total
Carcinogens (risks)										
Benzene	7.00E-14	2.17E-14	1.39E-11	7.73E-17	1.52E-15	2.96E-17	8.89E-19	3.67E-16	NA	1.40E-11
Benzo(a)pyrene	4.23E-11	2.14E-09	4.71E-09	NC	NC	NC	NC	NC	NA	6.89E-09
Benzo[a]anthracene	4.91E-11	2.84E-09	6.31E-09	NC	NC	NC	NC	NC	NA	9.20E-09
Benzo[b]fluoranthene	9.55E-12	1.08E-09	1.41E-09	NC	NC	NC	NC	NC	NA	2.50E-09
Benzo[k]fluoranthene	5.59E-13	3.59E-11	6.12E-11	NC	NC	NC	NC	NC	NA	9.77E-11
Chrysene	1.01E-12	3.17E-11	6.80E-11	NC	NC	NC	NC	NC	NA	1.01E-10
Dibenz[a,h]anthracene	1.43E-11	2.72E-09	7.90E-09	NC	NC	NC	NC	NC	NA	1.06E-08
Indeno[1,2,3-cd]pyrene	1.00E-12	4.29E-10	2.47E-09	NC	NC	NC	NC	NC	NA	2.90E-09
Arsenic	1.31E-10	3.36E-12	2.93E-11	7.21E-12	1.18E-11	NC	NC	NC	NA	1.83E-10
Chromium VI	3.31E-08	3.82E-10	4.91E-09	3.40E-09	5.07E-08	NC	NC	NC	NA	9.25E-08
Total by Pathway	3.33E-08	9.67E-09	2.79E-08	3.41E-09	5.07E-08	2.96E-17	8.89E-19	3.67E-16	NA	1.25E-07
Noncarcinogens (hazards)										
Benzaldehyde	3.39E-09	5.06E-10	6.39E-07	9.38E-13	1.85E-11	3.56E-13	1.06E-14	4.37E-12	NA	6.43E-07
Benzene	1.66E-09	5.14E-10	3.30E-07	1.83E-12	3.60E-11	7.01E-13	2.10E-14	8.69E-12	NA	3.32E-07
Methyl Ethyl Ketone	3.75E-10	3.71E-12	2.64E-08	2.14E-15	4.24E-14	8.08E-16	2.40E-17	9.88E-15	NA	2.68E-08
Styrene	5.35E-11	3.69E-10	5.81E-08	2.93E-12	5.67E-11	1.15E-12	3.54E-14	1.46E-11	NA	5.86E-08
Toluene	4.61E-11	3.89E-11	1.88E-08	2.37E-13	4.61E-12	9.16E-14	2.79E-15	1.15E-12	NA	1.89E-08
o-Xylene	1.90E-12	3.44E-12	1.74E-09	3.43E-14	6.55E-13	1.35E-14	4.18E-16	1.72E-13	NA	1.75E-09
2-Methylnaphthalene	2.39E-11	9.50E-10	3.15E-08	5.64E-12	1.04E-09	7.43E-12	9.69E-11	9.99E-11	NA	3.37E-08
Acenaphthene	1.87E-10	1.72E-10	1.94E-08	NC	NC	NC	NC	NC	NA	1.98E-08
Acenaphthylene	1.70E-09	1.37E-07	3.59E-06	NC	NC	NC	NC	NC	NA	3.73E-06
Anthracene	3.87E-11	1.11E-08	1.05E-07	NC	NC	NC	NC	NC	NA	1.16E-07
Furans	2.99E-09	3.52E-10	2.32E-07	5.85E-13	1.16E-11	2.19E-13	2.64E-12	2.72E-12	NA	2.35E-07
Manganese	NC	1.72E-11	3.01E-08	NC	NC	NC	NC	NC	NA	3.01E-08
Naphthalene	9.77E-09	1.26E-07	2.20E-05	1.61E-09	3.04E-08	6.50E-10	2.04E-11	8.42E-09	NA	2.22E-05

Table 60b (continued)

Chemical	Ingestion of: Surface Water	Soil	Vegetation	Beef	Milk	Pork	Poultry	Egg	Fish	Total
Phenol	1.04E-07	1.69E-09	2.03E-06	3.15E-12	6.21E-11	1.19E-12	3.55E-14	1.46E-11	NA	2.13E-06
Pyrene	9.23E-09	2.12E-11	9.24E-09	1.85E-08	3.23E-07	1.19E-09	4.30E-14	1.78E-11	NA	3.61E-07
n-Hexane	2.35E-13	3.26E-13	3.92E-11	1.13E-14	2.03E-13	2.01E-15	1.92E-14	1.98E-14	NA	4.00E-11
Antimony	7.64E-05	4.44E-06	3.81E-05	3.50E-06	1.93E-05	NC	NC	NC	NA	1.42E-04
Arsenic	3.39E-06	8.70E-08	7.60E-07	1.87E-07	3.07E-07	NC	NC	NC	NA	4.73E-06
Barium	4.87E-05	2.38E-06	2.13E-05	3.00E-07	3.85E-05	NC	NC	NC	NA	1.11E-04
Cadmium	3.01E-05	4.40E-06	6.80E-05	3.19E-07	9.72E-07	6.41E-08	1.41E-06	3.43E-08	NA	1.05E-04
Chlorine	6.30E-02	1.14E-07	NC	1.75E-07	9.57E-07	NC	NC	NC	NA	6.30E-02
Chromium	2.06E-13	3.13E-09	2.49E-09	1.02E-09	1.32E-08	NC	NC	NC	NA	1.98E-08
Chromium VI	3.14E-06	3.63E-08	4.65E-07	3.22E-07	4.81E-06	NC	NC	NC	NA	8.77E-06
Nickel	1.17E-07	1.33E-08	6.22E-08	4.10E-08	3.71E-07	NC	NC	NC	NA	6.05E-07
Selenium	3.18E-06	2.97E-09	1.40E-07	3.93E-08	5.57E-06	1.17E-07	2.69E-09	2.77E-09	NA	9.06E-06
Silver	2.62E-05	6.30E-08	2.63E-06	7.17E-07	2.64E-04	NC	NC	NC	NA	2.94E-04
Zinc	1.27E-07	1.33E-08	1.47E-07	7.59E-10	1.52E-08	1.07E-10	2.66E-10	2.74E-10	NA	3.04E-07

NC - Not Calculated NA - Not Applicable

Table 60c Estimates of Risk and Hazard by the Subsistence Fisher for the Drill Tower Scenario

Chemical	Ingestion of: Surface Water	Soil	Vegetation	Beef	Milk	Pork	Poultry	Egg	Fish	Total
Carcinogens (risks)										
Benzene	1.57E-13	1.16E-14	1.16E-11	NA	NA	NA	NA	NA	2.28E-13	1.20E-11
Benzo(a)pyrene	9.46E-11	1.15E-09	4.20E-09	NA	NA	NA	NA	NA	5.51E-08	6.05E-08
Benzo[a]anthracene	1.10E-10	1.52E-09	5.64E-09	NA	NA	NA	NA	NA	3.28E-08	4.01E-08
Benzo[b]fluoranthene	2.14E-11	5.79E-10	1.25E-09	NA	NA	NA	NA	NA	1.25E-08	1.43E-08
Benzo[k]fluoranthene	1.25E-12	1.92E-11	5.44E-11	NA	NA	NA	NA	NA	7.29E-10	8.04E-10
Chrysene	2.27E-12	1.70E-11	6.08E-11	NA	NA	NA	NA	NA	7.99E-10	8.79E-10
Dibenz[a,h]anthracene	3.21E-11	1.46E-09	7.02E-09	NA	NA	NA	NA	NA	2.40E-08	3.25E-08
Indeno[1,2,3-cd]pyrene	2.24E-12	2.30E-10	2.20E-09	NA	NA	NA	NA	NA	1.72E-09	4.15E-09
Arsenic	2.93E-10	1.80E-12	2.62E-11	NA	NA	NA	NA	NA	3.42E-10	6.63E-10
Chromium VI	7.40E-08	2.05E-10	4.38E-09	NA	NA	NA	NA	NA	1.30E-08	9.16E-08
Total by Pathway	7.46E-08	5.18E-09	2.48E-08	NA	NA	NA	NA	NA	1.41E-07	2.45E-07
Noncarcinogens (hazards)										
Benzaldehyde	1.52E-09	5.42E-11	1.07E-07	NA	NA	NA	NA	NA	6.94E-10	1.10E-07
Benzene	7.42E-10	5.51E-11	5.49E-08	NA	NA	NA	NA	NA	1.08E-09	5.68E-08
Methyl Ethyl Ketone	1.68E-10	3.98E-13	4.41E-09	NA	NA	NA	NA	NA	9.45E-12	4.58E-09
Styrene	2.39E-11	3.96E-11	9.85E-09	NA	NA	NA	NA	NA	1.39E-10	1.01E-08
Toluene	2.06E-11	4.17E-12	3.09E-09	NA	NA	NA	NA	NA	7.57E-11	3.19E-09
o-Xylene	8.52E-13	3.69E-13	2.82E-10	NA	NA	NA	NA	NA	7.03E-12	2.90E-10
2-Methylnaphthalene	1.07E-11	1.02E-10	5.55E-09	NA	NA	NA	NA	NA	2.48E-10	5.91E-09
Acenaphthene	8.39E-11	1.84E-11	3.18E-09	NA	NA	NA	NA	NA	2.98E-09	6.27E-09
Acenaphthylene	7.60E-10	1.47E-08	6.31E-07	NA	NA	NA	NA	NA	2.58E-09	6.49E-07
Anthracene	1.73E-11	1.19E-09	1.91E-08	NA	NA	NA	NA	NA	2.64E-09	2.30E-08
Furans	1.34E-09	3.78E-11	4.16E-08	NA	NA	NA	NA	NA	4.99E-10	4.35E-08
Manganese	NC	1.84E-12	5.37E-09	NA	NA	NA	NA	NA	NC	5.37E-09
Naphthalene	4.37E-09	1.35E-08	3.61E-06	NA	NA	NA	NA	NA	5.50E-08	3.68E-06

Table 60c (continued)

Chemical	Ingestion of: Surface Water	Soil	Vegetation	Beef	Milk	Pork	Poultry	Egg	Fish	Total
Phenol	4.65E-08	1.81E-10	3.42E-07	NA	NA	NA	NA	NA	2.12E-08	4.10E-07
Pyrene	4.13E-09	2.27E-12	1.65E-09	NA	NA	NA	NA	NA	2.88E-06	2.88E-06
n-Hexane	1.05E-13	3.49E-14	6.81E-12	NA	NA	NA	NA	NA	1.15E-12	8.10E-12
Antimony	3.42E-05	4.76E-07	6.82E-06	NA	NA	NA	NA	NA	8.01E-05	1.22E-04
Arsenic	1.52E-06	9.32E-09	1.36E-07	NA	NA	NA	NA	NA	1.77E-06	3.44E-06
Barium	2.18E-05	2.55E-07	3.82E-06	NA	NA	NA	NA	NA	8.07E-04	8.33E-04
Cadmium	1.35E-05	4.71E-07	1.23E-05	NA	NA	NA	NA	NA	1.97E-04	2.23E-04
Chlorine	2.82E-02	1.23E-08	NC	NA	NA	NA	NA	NA	NC	2.82E-02
Chromium	9.24E-14	3.36E-10	4.46E-10	NA	NA	NA	NA	NA	1.03E-12	7.83E-10
Chromium VI	1.40E-06	3.89E-09	8.31E-08	NA	NA	NA	NA	NA	2.46E-07	1.74E-06
Nickel	5.24E-08	1.42E-09	1.11E-08	NA	NA	NA	NA	NA	2.39E-07	3.04E-07
Selenium	1.42E-06	3.18E-10	2.49E-08	NA	NA	NA	NA	NA	1.07E-05	1.22E-05
Silver	1.17E-05	6.76E-09	4.71E-07	NA	NA	NA	NA	NA	1.40E-04	1.52E-04
Zinc	5.71E-08	1.42E-09	2.63E-08	NA	NA	NA	NA	NA	6.88E-06	6.96E-06

NC - Not Calculated NA - Not Applicable

Table 60d Estimates of Risk and Hazard by the Subsistence Fisher Child for the Drill Tower Scenario

	Ingestion of:								
Chemical	Surface Water	Soil	Vegetation	Beef	Milk	Pork	Poultry	Egg	Fish	Total
Carcinogens (risks)										
Benzene	7.00E-14	2.17E-14	3.48E-12	NA	NA	NA	NA	NA	2.95E-14	3.60E-12
Benzo(a)pyrene	4.23E-11	2.14E-09	1.18E-09	NA	NA	NA	NA	NA	7.15E-09	1.05E-08
Benzo[a]anthracene	4.91E-11	2.84E-09	1.58E-09	NA	NA	NA	NA	NA	4.25E-09	8.72E-09
Benzo[b]fluoranthene	9.55E-12	1.08E-09	3.53E-10	NA	NA	NA	NA	NA	1.62E-09	3.06E-09
Benzo[k]fluoranthene	5.59E-13	3.59E-11	1.53E-11	NA	NA	NA	NA	NA	9.46E-11	1.46E-10
Chrysene	1.01E-12	3.17E-11	1.70E-11	NA	NA	NA	NA	NA	1.04E-10	1.53E-10
Dibenz[a,h]anthracene	1.43E-11	2.72E-09	1.97E-09	NA	NA	NA	NA	NA	3.12E-09	7.82E-09
Indeno[1,2,3-cd]pyrene	1.00E-12	4.29E-10	6.17E-10	NA	NA	NA	NA	NA	2.23E-10	1.27E-09
Arsenic	1.31E-10	3.36E-12	7.33E-12	NA	NA	NA	NA	NA	4.44E-11	1.86E-10
Chromium VI	3.31E-08	3.82E-10	1.23E-09	NA	NA	NA	NA	NA	1.69E-09	3.64E-08
Total by Pathway	3.33E-08	9.67E-09	6.97E-09	NA	NA	NA	NA	NA	1.83E-08	6.82E-08
Noncarcinogens (hazards)										
Benzaldehyde	3.39E-09	5.06E-10	1.60E-07	NA	NA	NA	NA	NA	4.50E-10	1.64E-07
Benzene	1.66E-09	5.14E-10	8.24E-08	NA	NA	NA	NA	NA	6.99E-10	8.53E-08
Methyl Ethyl Ketone	3.75E-10	3.71E-12	6.60E-09	NA	NA	NA	NA	NA	6.13E-12	6.98E-09
Styrene	5.35E-11	3.69E-10	1.45E-08	NA	NA	NA	NA	NA	9.01E-11	1.50E-08
Toluene	4.61E-11	3.89E-11	4.70E-09	NA	NA	NA	NA	NA	4.91E-11	4.84E-09
o-Xylene	1.90E-12	3.44E-12	4.36E-10	NA	NA	NA	NA	NA	4.56E-12	4.45E-10
2-Methylnaphthalene	2.39E-11	9.50E-10	7.86E-09	NA	NA	NA	NA	NA	1.61E-10	9.00E-09
Acenaphthene	1.87E-10	1.72E-10	4.86E-09	NA	NA	NA	NA	NA	1.93E-09	7.15E-09
Acenaphthylene	1.70E-09	1.37E-07	8.98E-07	NA	NA	NA	NA	NA	1.68E-09	1.04E-06
Anthracene	3.87E-11	1.11E-08	2.63E-08	NA	NA	NA	NA	NA	1.71E-09	3.92E-08
Furans	2.99E-09	3.52E-10	5.80E-08	NA	NA	NA	NA	NA	3.23E-10	6.17E-08
Manganese	NC	1.72E-11	7.52E-09	NA	NA	NA	NA	NA	NC	7.54E-09
Naphthalene	9.77E-09	1.26E-07	5.49E-06	NA	NA	NA	NA	NA	3.57E-08	5.67E-06

Table 60d (continued)

Chemical	Ingestion of:									Total
	Surface Water	Soil	Vegetation	Beef	Milk	Pork	Poultry	Egg	Fish	
Phenol	1.04E-07	1.69E-09	5.07E-07	NA	NA	NA	NA	NA	1.38E-08	6.26E-07
Pyrene	9.23E-09	2.12E-11	2.31E-09	NA	NA	NA	NA	NA	1.87E-06	1.88E-06
n-Hexane	2.35E-13	3.26E-13	9.80E-12	NA	NA	NA	NA	NA	7.43E-13	1.11E-11
Antimony	7.64E-05	4.44E-06	9.53E-06	NA	NA	NA	NA	NA	5.20E-05	1.42E-04
Arsenic	3.39E-06	8.70E-08	1.90E-07	NA	NA	NA	NA	NA	1.15E-06	4.82E-06
Barium	4.87E-05	2.38E-06	5.32E-06	NA	NA	NA	NA	NA	5.24E-04	5.80E-04
Cadmium	3.01E-05	4.40E-06	1.70E-05	NA	NA	NA	NA	NA	1.28E-04	1.79E-04
Chlorine	6.30E-02	1.14E-07	NC	NA	NA	NA	NA	NA	NC	6.30E-02
Chromium	2.06E-13	3.13E-09	6.23E-10	NA	NA	NA	NA	NA	6.66E-13	3.76E-09
Chromium VI	3.14E-06	3.63E-08	1.16E-07	NA	NA	NA	NA	NA	1.60E-07	3.45E-06
Nickel	1.17E-07	1.33E-08	1.55E-08	NA	NA	NA	NA	NA	1.55E-07	3.01E-07
Selenium	3.18E-06	2.97E-09	3.49E-08	NA	NA	NA	NA	NA	6.97E-06	1.02E-05
Silver	2.62E-05	6.30E-08	6.58E-07	NA	NA	NA	NA	NA	9.08E-05	1.18E-04
Zinc	1.27E-07	1.33E-08	3.66E-08	NA	NA	NA	NA	NA	4.46E-06	4.64E-06

NC - Not Calculated NA - Not Applicable

Table 60e Estimates of Risk and Hazard by the Adult Resident for the Drill Tower Scenario

Chemical	Ingestion of: Surface Water	Soil	Vegetation	Beef	Milk	Pork	Poultry	Egg	Fish	Total
Carcinogens (risks)										
Benzene	1.57E-13	1.16E-14	1.16E-11	NA	NA	NA	NA	NA	NA	1.18E-11
Benzo(a)pyrene	9.46E-11	1.15E-09	4.20E-09	NA	NA	NA	NA	NA	NA	5.45E-09
Benzo[a]anthracene	1.10E-10	1.52E-09	5.64E-09	NA	NA	NA	NA	NA	NA	7.27E-09
Benzo[b]fluoranthene	2.14E-11	5.79E-10	1.25E-09	NA	NA	NA	NA	NA	NA	1.85E-09
Benzo[k]fluoranthene	1.25E-12	1.92E-11	5.44E-11	NA	NA	NA	NA	NA	NA	7.48E-11
Chrysene	2.27E-12	1.70E-11	6.08E-11	NA	NA	NA	NA	NA	NA	8.00E-11
Dibenz[a,h]anthracene	3.21E-11	1.46E-09	7.02E-09	NA	NA	NA	NA	NA	NA	8.51E-09
Indeno[1,2,3-cd]pyrene	2.24E-12	2.30E-10	2.20E-09	NA	NA	NA	NA	NA	NA	2.43E-09
Arsenic	2.93E-10	1.80E-12	2.62E-11	NA	NA	NA	NA	NA	NA	3.21E-10
Chromium VI	7.40E-08	2.05E-10	4.38E-09	NA	NA	NA	NA	NA	NA	7.86E-08
Total by Pathway	7.46E-08	5.18E-09	2.48E-08	NA	NA	NA	NA	NA	NA	1.05E-07
Noncarcinogens (hazards)										
Benzaldehyde	1.52E-09	5.42E-11	1.07E-07	NA	NA	NA	NA	NA	NA	1.09E-07
Benzene	7.42E-10	5.51E-11	5.49E-08	NA	NA	NA	NA	NA	NA	5.57E-08
Methyl Ethyl Ketone	1.68E-10	3.98E-13	4.41E-09	NA	NA	NA	NA	NA	NA	4.58E-09
Styrene	2.39E-11	3.96E-11	9.85E-09	NA	NA	NA	NA	NA	NA	9.91E-09
Toluene	2.06E-11	4.17E-12	3.09E-09	NA	NA	NA	NA	NA	NA	3.11E-09
o-Xylene	8.52E-13	3.69E-13	2.82E-10	NA	NA	NA	NA	NA	NA	2.83E-10
2-Methylnaphthalene	1.07E-11	1.02E-10	5.55E-09	NA	NA	NA	NA	NA	NA	5.67E-09
Acenaphthene	8.39E-11	1.84E-11	3.18E-09	NA	NA	NA	NA	NA	NA	3.29E-09
Acenaphthylene	7.60E-10	1.47E-08	6.31E-07	NA	NA	NA	NA	NA	NA	6.46E-07
Anthracene	1.73E-11	1.19E-09	1.91E-08	NA	NA	NA	NA	NA	NA	2.04E-08
Furans	1.34E-09	3.78E-11	4.16E-08	NA	NA	NA	NA	NA	NA	4.30E-08
Manganese	NC	1.84E-12	5.37E-09	NA	NA	NA	NA	NA	NA	5.37E-09
Naphthalene	4.37E-09	1.35E-08	3.61E-06	NA	NA	NA	NA	NA	NA	3.63E-06

Table 60e (continued)

Chemical	Ingestion of: Surface Water	Soil	Vegetation	Beef	Milk	Pork	Poultry	Egg	Fish	Total
Phenol	4.65E-08	1.81E-10	3.42E-07	NA	NA	NA	NA	NA	NA	3.89E-07
Pyrene	4.13E-09	2.27E-12	1.65E-09	NA	NA	NA	NA	NA	NA	5.78E-09
n-Hexane	1.05E-13	3.49E-14	6.81E-12	NA	NA	NA	NA	NA	NA	6.95E-12
Antimony	3.42E-05	4.76E-07	6.82E-06	NA	NA	NA	NA	NA	NA	4.15E-05
Arsenic	1.52E-06	9.32E-09	1.36E-07	NA	NA	NA	NA	NA	NA	1.66E-06
Barium	2.18E-05	2.55E-07	3.82E-06	NA	NA	NA	NA	NA	NA	2.59E-05
Cadmium	1.35E-05	4.71E-07	1.23E-05	NA	NA	NA	NA	NA	NA	2.62E-05
Chlorine	2.82E-02	1.23E-08	NC	NA	NA	NA	NA	NA	NA	2.82E-02
Chromium	9.24E-14	3.36E-10	4.46E-10	NA	NA	NA	NA	NA	NA	7.82E-10
Chromium VI	1.40E-06	3.89E-09	8.31E-08	NA	NA	NA	NA	NA	NA	1.49E-06
Nickel	5.24E-08	1.42E-09	1.11E-08	NA	NA	NA	NA	NA	NA	6.50E-08
Selenium	1.42E-06	3.18E-10	2.49E-08	NA	NA	NA	NA	NA	NA	1.45E-06
Silver	1.17E-05	6.76E-09	4.71E-07	NA	NA	NA	NA	NA	NA	1.22E-05
Zinc	5.71E-08	1.42E-09	2.63E-08	NA	NA	NA	NA	NA	NA	8.48E-08

NC - Not Calculated NA - Not Applicable

Table 60f Estimates of Risk and Hazard by the Child Resident for the Drill Tower Scenario

Chemical	Ingestion of: Surface Water	Soil	Vegetation	Beef	Milk	Pork	Poultry	Egg	Fish	Total
Carcinogens (risks)										
Benzene	7.00E-14	2.17E-14	3.48E-12	NA	NA	NA	NA	NA	NA	3.58E-12
Benzo(a)pyrene	4.23E-11	2.14E-09	1.18E-09	NA	NA	NA	NA	NA	NA	3.36E-09
Benzo[a]anthracene	4.91E-11	2.84E-09	1.58E-09	NA	NA	NA	NA	NA	NA	4.47E-09
Benzo[b]Fluoranthene	9.55E-12	1.08E-09	3.53E-10	NA	NA	NA	NA	NA	NA	1.44E-09
Benzo[k]Fluoranthene	5.59E-13	3.59E-11	1.53E-11	NA	NA	NA	NA	NA	NA	5.17E-11
Chrysene	1.01E-12	3.17E-11	1.70E-11	NA	NA	NA	NA	NA	NA	4.98E-11
Dibenz[a,h]anthracene	1.43E-11	2.72E-09	1.97E-09	NA	NA	NA	NA	NA	NA	4.71E-09
Indeno[1,2,3-cd]pyrene	1.00E-12	4.29E-10	6.17E-10	NA	NA	NA	NA	NA	NA	1.05E-09
Arsenic	1.31E-10	3.36E-12	7.33E-12	NA	NA	NA	NA	NA	NA	1.41E-10
Chromium VI	3.31E-08	3.82E-10	1.23E-09	NA	NA	NA	NA	NA	NA	3.47E-08
Total by Pathway	3.33E-08	9.67E-09	6.97E-09	NA	NA	NA	NA	NA	NA	4.99E-08
Noncarcinogens (hazards)										
Benzaldehyde	3.39E-09	5.06E-10	1.60E-07	NA	NA	NA	NA	NA	NA	1.64E-07
Benzene	1.66E-09	5.14E-10	8.24E-08	NA	NA	NA	NA	NA	NA	8.46E-08
Methyl Ethyl Ketone	3.75E-10	3.71E-12	6.60E-09	NA	NA	NA	NA	NA	NA	6.97E-09
Styrene	5.35E-11	3.69E-10	1.45E-08	NA	NA	NA	NA	NA	NA	1.49E-08
Toluene	4.61E-11	3.89E-11	4.70E-09	NA	NA	NA	NA	NA	NA	4.79E-09
o-Xylene	1.90E-12	3.44E-12	4.36E-10	NA	NA	NA	NA	NA	NA	4.41E-10
2-Methylnaphthalene	2.39E-11	9.50E-10	7.86E-09	NA	NA	NA	NA	NA	NA	8.84E-09
Acenaphthene	1.87E-10	1.72E-10	4.86E-09	NA	NA	NA	NA	NA	NA	5.22E-09
Acenaphthylene	1.70E-09	1.37E-07	8.98E-07	NA	NA	NA	NA	NA	NA	1.04E-06
Anthracene	3.87E-11	1.11E-08	2.63E-08	NA	NA	NA	NA	NA	NA	3.75E-08
Furans	2.99E-09	3.52E-10	5.80E-08	NA	NA	NA	NA	NA	NA	6.13E-08
Manganese	NC	1.72E-11	7.52E-09	NA	NA	NA	NA	NA	NA	7.54E-09
Naphthalene	9.77E-09	1.26E-07	5.49E-06	NA	NA	NA	NA	NA	NA	5.63E-06

Table 60f (continued)

Chemical	Ingestion of: Surface Water	Soil	Vegetation	Beef	Milk	Pork	Poultry	Egg	Fish	Total
Phenol	1.04E-07	1.69E-09	5.07E-07	NA	NA	NA	NA	NA	NA	6.12E-07
Pyrene	9.23E-09	2.12E-11	2.31E-09	NA	NA	NA	NA	NA	NA	1.16E-08
n-Hexane	2.35E-13	3.26E-13	9.80E-12	NA	NA	NA	NA	NA	NA	1.04E-11
Antimony	7.64E-05	4.44E-06	9.53E-06	NA	NA	NA	NA	NA	NA	9.04E-05
Arsenic	3.39E-06	8.70E-08	1.90E-07	NA	NA	NA	NA	NA	NA	3.67E-06
Barium	4.87E-05	2.38E-06	5.32E-06	NA	NA	NA	NA	NA	NA	5.64E-05
Cadmium	3.01E-05	4.40E-06	1.70E-05	NA	NA	NA	NA	NA	NA	5.15E-05
Chlorine	6.30E-02	1.14E-07	NC	NA	NA	NA	NA	NA	NA	6.30E-02
Chromium	2.06E-13	3.13E-09	6.23E-10	NA	NA	NA	NA	NA	NA	3.76E-09
Chromium VI	3.14E-06	3.63E-08	1.16E-07	NA	NA	NA	NA	NA	NA	3.29E-06
Nickel	1.17E-07	1.33E-08	1.55E-08	NA	NA	NA	NA	NA	NA	1.46E-07
Selenium	3.18E-06	2.97E-09	3.49E-08	NA	NA	NA	NA	NA	NA	3.22E-06
Silver	2.62E-05	6.30E-08	6.58E-07	NA	NA	NA	NA	NA	NA	2.69E-05
Zinc	1.27E-07	1.33E-08	3.66E-08	NA	NA	NA	NA	NA	NA	1.77E-07

NC - Not Calculated NA - Not Applicable

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